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United States Patent [19]

Jahn

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[45] **Date of Patent: Nov. 17, 1987**

[54] **DEVICE FOR APPLYING MEDIUM AFTER TERMINATION OF THE PRINTING OPERATION IN A PRINTING MACHINE**

[75] Inventor: **Hans-Georg Jahn,** Wiesenbach, Fed. Rep. of Germany

[73] Assignee: **Heidelberger Druckmaschinen AG,** Heidelberg, Fed. Rep. of Germany

[21] Appl. No.: **735,954**

[22] Filed: **May 20, 1985**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 626,732, Jul. 2, 1984, abandoned.

[30] **Foreign Application Priority Data**

Jul. 5, 1983 [DE] Fed. Rep. of Germany 3324096

[51] **Int. Cl.**^{4} **B05C 1/02; B05C** 11/10

[52] **U.S. Cl.** **118/46;** 118/211; 118/236; **118/249;** 118/262

[58] **Field of Search** 118/46, 236, 249, 104, 118/203, 211, 247, 262

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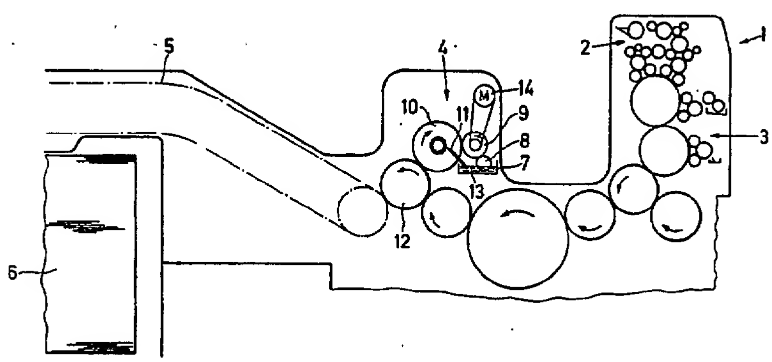
Primary Examiner—Evan K. Lawrence
Attorney, Agent, or Firm—Herbert L. Lerner; Laurence A. Greenberg

[57] **ABSTRACT**

In a printing machine, a medium applicator disposed downstream of printing units of the machine, in travel direction of a sheet which has been printed, the applicator having three rollers including a first roller for taking up medium from a supply container, a second roller for metering a quantity of the medium to be applied, and a third roller having the same diameter as that of cylinders of the printing units for transferring the medium, includes a rubber lining disposed on the third roller for directly applying the medium onto the printed sheet; the three rollers, during application of the medium, being in constant meshing engagement with a sheet-transferring cylinder; a device for uncoupling the three rollers from the sheet-transferring cylinder, and a separate motor for driving the three rollers when the rollers are uncoupled.

6 Claims, 6 Drawing Figures



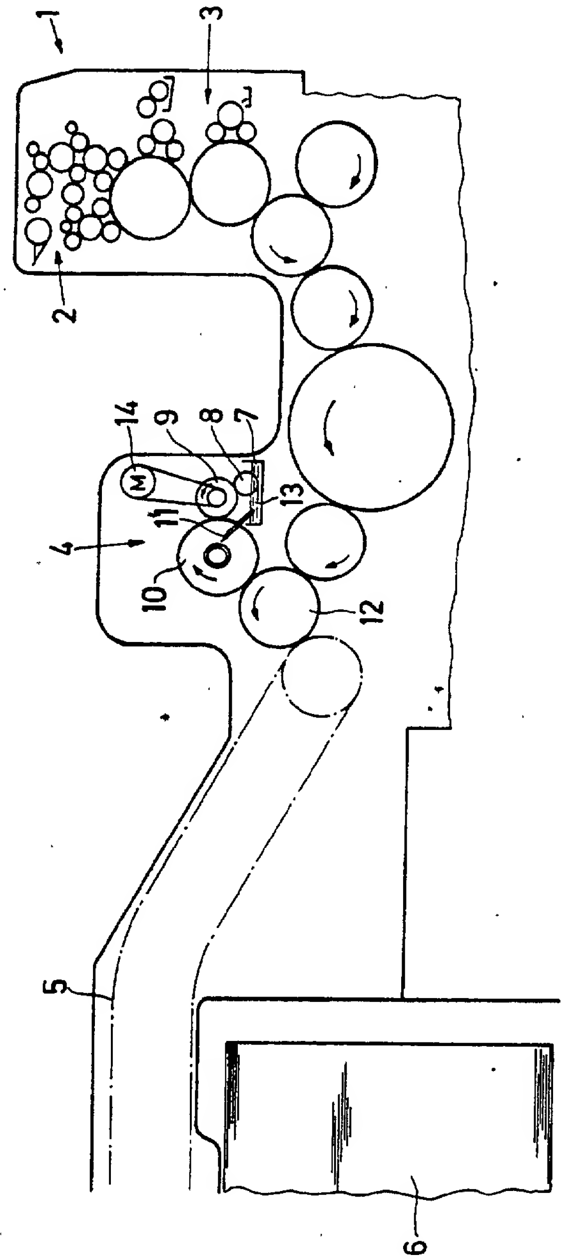


Fig. 1

Fig. 2

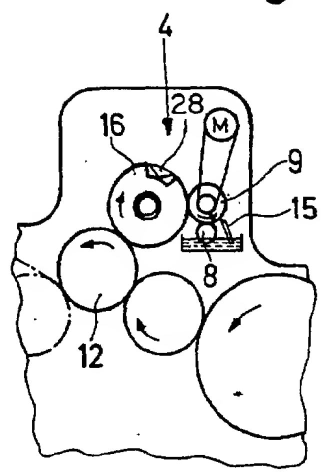


Fig. 3

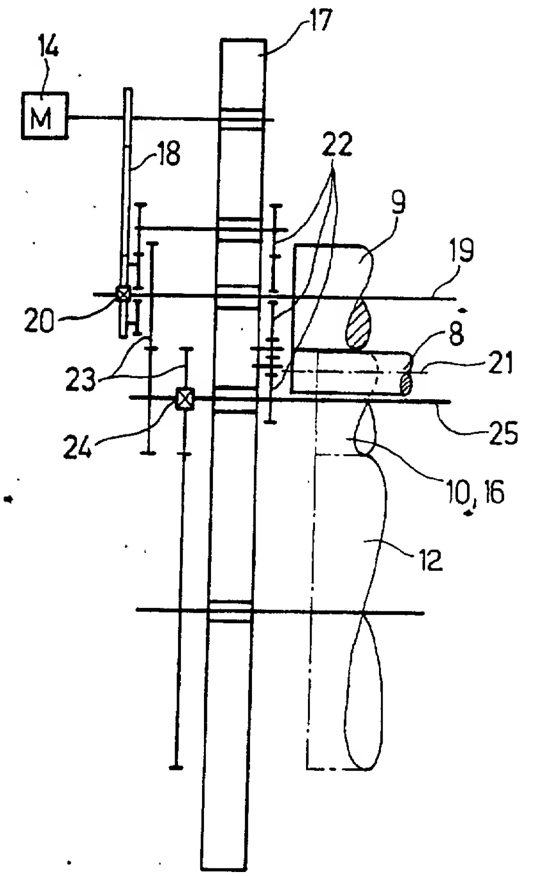


Fig. 4

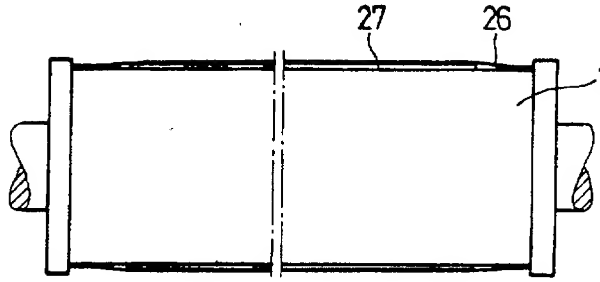


Fig. 5

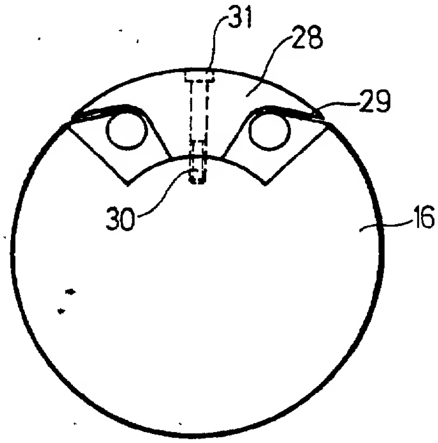
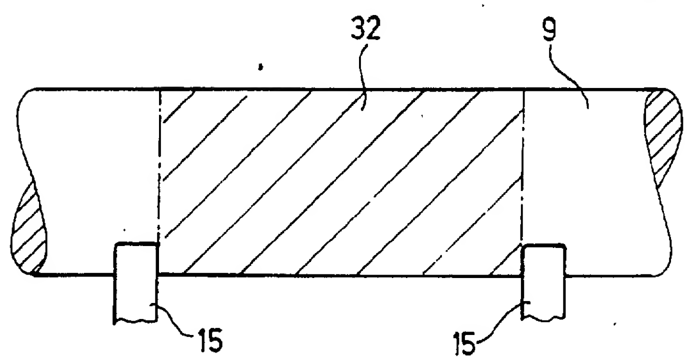


Fig. 6



DEVICE FOR APPLYING MEDIUM AFTER TERMINATION OF THE PRINTING OPERATION IN A PRINTING MACHINE

This is a continuation-in-part application of Ser. No. 626,732, filed July 2, 1984, and now abandoned.

The invention relates to a device in printing machines for applying a medium, such as lacquer, especially, by means of three rollers, after the printing process has been terminated, the rollers including a first roller for taking up medium from a supply container, a second roller for metering a quantity of the medium to be applied and a third roller having the same diameter as that of cylinders of the printing units for transferring the medium to a printed sheet.

A lacquering or varnishing device in printing machines has become known theretofore from German Published Non-Prosecuted Application No. (DE-OS) 30 46 257. This device includes a lacquer storage tank or supply container and a scooping roller dipping into this tank. The lacquer taken up by the scooping roller is fed in metered fashion to an applicator roller. Two ductor rollers, by means of which a format-related lacquer feed occurs, can be set close to the scooping roller. A ductor blade applicable against the metering roller is also provided. This ductor blade serves to wipe superfluous lacquer from the metering roller and to return it to the supply container.

A specific disadvantage of this heretofore known device is that the lacquer is fed to the varnishing or lacquering cylinder via a distributor roller and an applicator roller. Because of the relatively long transport distance which the lacquer has to cover over many rollers until it reaches the printed sheet, the lacquer begins to set i.e. no quick-drying lacquers can be used. Due to this limitation to slowly drying lacquers, when the sheet is delivered the reverse side or back of the next following sheet will smear the lacquer and thus paste the sheets together. Consequently, no full sheet piles can be set up, because the pile weight which is built up at the delivery end and which applies a load to the individual sheets also limits the lacquer layer thickness.

In the device described in German Pat. No. 23 45 183 for applying a medium there are provided a dipping roller, a metering roller, an applicator roller, a back-pressure cylinder, a form cylinder and another applicator roller. The two applicator rollers, the dipping roller and the metering roller are combined into a common structural unit. Within this structural unit, either the dipping roller with the form cylinder or the first applicator roller with the form cylinder or the second applicator roller with the back-pressure cylinder can cooperate.

A disadvantage of this last-mentioned construction is that the lacquer must first be fed to the printed material via the form cylinder. The platen mounted on the clamping device at the form cylinder forms a channel in which the lacquer accumulates after a given operating time. This lacquer-accumulation results in an irregular lacquer application due to dripping of the lacquer down onto the printed material.

German Pat. No. 20 20 584 is based upon a device for avoiding smearing of the ink due to lacquering. By means of a lacquering unit, the lacquer is applied to a printing- unit cylinder. This printing-unit cylinder, which has the same diameter as that of the cylinders of the preceding printing units, transfers the lacquer to the printed material. The disadvantages referred to hereinbefore are also applicable to this construction and require additionally, time-consuming cleaning work to be performed on the rollers. Moreover, the construction of the printing unit is complicated by having to attach the lacquering unit to the rubber of the blanket cylinder.

A further disadvantage of the state of art as exemplified by the references cited hereinbefore, is that, due to the directions of rotation of the rollers, the format-related wiping by the ductor blade cannot be observed, thus making impossible a precise wiping or removal of the superfluous lacquer material.

It is, accordingly, an object of the invention to provide a device for applying a medium such as lacquering unit in a printing machine, wherein the medium, such as lacquer, has to travel over the shortest possible distance from the storage tank or supply container to the printed material, and wherein drying of the lacquer on the rollers is prevented, when the lacquering unit is connectible and disconnectible, as required.

With the foregoing and other objects in view, there is provided, in accordance with the invention, in a printing machine, a medium applicator disposed downstream of printing units of the machine in the travel direction of a sheet which has been printed, the applicator having three rollers including a first roller for taking up medium from a supply container, a second roller for metering a quantity of the medium to be applied, and a third roller having the same diameter as that of cylinders of the printing units for transferring the medium comprising a rubber lining disposed on the third roller for directly applying the medium onto the printed sheet; the three rollers, during application of the medium being in constant meshing engagement with a sheet-transferring cylinder; means for uncoupling the three rollers from the sheet-transferring cylinder, and separate motor means for driving the three rollers when the rollers are uncoupled.

In accordance with another feature of the invention, the third roller is in the form of a cylinder with a continuous surface.

Due to the fact that the cylinder surface of the applicator roller is not broken by a channel, the lacquer can be applied uniformly. Thus, the burdensome cleaning operations can be dispensed with. Because of the limitation to this relatively small number of rollers, it is possible, for example, to apply the lacquer directly to the sheet after the last ink impression i.e. to bring it on-line. When, for example, printed cardboard, which is to be converted afterwards into packaging material, is provided with such a lacquer layer, then this packaging material receives increased portection thereby which is of advantage during the subsequent transport operation. Moreover, the gloss provided by the lacquer enhances the effect of the impression. The cardboard or pastboard treated in this way is also better protected against environmental influence.

Because the rollers, during the application of the medium are in constant meshing contact with the cylinder, assurance is provided that the subsequent or further treatment of the surfaces of the printed material occurs at the speed of the printing machine.

Disengagement of the lacquering device from the cylinder provides the possibility of excluding a given portion of the impression from any subsequent treatment. The motor provided for driving the rollers of the applicator of lacquering prevents drying of the medium

on the rollers. Thus, the burdensome cleaning activities can be dispensed with for the next operating cycle.

In accordance with a further feature of the invention, the rubber lining on the third roller is a rubber cloth applied in an abuttting manner, the third roller having the same diameter as that of the sheet-transferring cylinder; and the third roller being connected by a single-revolution clutch to the sheet-transferring cylinder.

It is thereby possible to use any type of cylinders, because, in this form of application of the rubber cloth or blanket also, no channel is formed in which the lacquer might otherwise accumulate. The third roller has the same diameter as a printing-unit cylinder.

In accordance with an added feature of the invention, there is provided a ductor blade disposed on at least one of the end faces of the third roller serving to transfer the medium to the printed sheet, the ductor blade being disposed so that when superfluous medium is removed by the ductor blade, the thus removed superfluous medum can flow back into the supply container. Thus, an economical use of the medium, in the further treatment is afforded thereby, and contamination of the printing machine is prevented.

In accordance with an additional feature of the invention, the third roller is in the form of a cylinder having a channel formed therein; and including an insert member received in channel so as to complete a continuous cylinder. By inserting a filling piece or insert member into this channel, which can be covered by a rubber cloth or blanket, the benefits of a full or solid cylinder can also be attained.

When such cylinders are used, in accordance with a concomitant feature of the invention, a ductor blade is disposed on the second roller. Thus, precise metering of the medium or lacquer occurs in conformity with the sheet format. A particularly advantageous metering process is also ensured due to the directions of rotation of the rollers, because, in this arrangement, the applcation of the lacquer is always effected from above.

Other features which are considered as characteristic for the invention are set forth in the appended claims.

Although the invention is illustrated and described herein as embodied in a device for applying medium after termination of the printing operation in a printing machine, it is nevertheless not intended to be limited to the details shown, since various modifications and structural changes may be made therien without departing from the spirit of the invention and within the scope and range of equivalents of the claims.

The construction and method of operation of the invention, however, together with additional objects and advantages thereof will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

FIG. 1 is a diagrammatic elevational view of a printing machine with lacquering unit and a ductor blade assembly arranged at an applicator roller and disposed in front of the delivery unit; and

FIG. 2 is a fragmentary view of FIG. 1 showing the printing machine with lacquering unit and with a ductor blade arranged at a metering roller.

FIG. 3 is a diagrammatic side elevational view of the gearing and uncoupling mechanism for the rollers of the lacquering unit;

FIG. 4 is a diagrammatic axial view of a sheet transferring cylinder of the lacquering unit equipped with a format-related underlay;

FIG. 5 is an end view of one of the rollers of the laquering unit which is formed with a longitudinal channel wherein an insert member is received; and

FIG. 6 is a diagrammatic longitudinal view of the metering roller of the lacquering unit and showing ductor blades disposed thereon.

Referring now to the drawing and first, particularly, to FIG. 1 thereof, there is shown a printing machine with a final last printing unit 1 equipped with a conventional inking unit 2 and a conventional dampening unit 3. This last printing unit 1 is followed by a lacquering unit 4. The printed sheets are fed by the last printing unit 1 to the lacquering unit 4. Subsequent to a final treatment of the sheets by the lacquering unit 4, the sheets are seized by a delivery chain 5 and thus transported to a delivery pile 6.

The lacquering unit 4 which is arranged downstream of or behind the last printing unit 1 in travel direction of the sheets is formed of a dipping roller 8 revolving within a supply container or tank 7, a metering roller 9 and an applicator roller 10 provided with a rubber lining or covering (not shown). At an end face of this applicator roller 10, there is additionally a ductor blade 11. The specific character of the applicator roller 10, which has the same diameter as that of a sheet transferring cylinder 12, is maintained both when it is covered with a separate rubber cloth or blanket and the channel formed therein covered by an insert member or a filling or loading piece, or, alternatively, when a rubber cloth of blanket is applied so that the leading and trailing edges thereof abut. Consequently, it is also possible to limit the applicator of the lacquer to specific areas. The applicator roller 10 is in direct contact with the cylinder 12 which is provided with an elevator mechanism adapted to the sheet format and on which the printed sheet which is to be further processed is located. This cylinder 12 is equipped with non-illustrated grippers disposed in recesses i.e. the gripper back is at a deeper level than the surface of the sheet which is to be further processed. After the further processing has been completed, the cylinder 12 transfers the sheet to the conveyor or delivery chain 5 of the delivery unit which conveys the sheet to the deliver pile 6.

The storage tank or supply container 7 contains a medium or agent 13 to be used for the further treatment or processing of the printed sheets. This medium may be either a lacquer or a rubber cement or any other agent suited for this purpose. During the rotating movement of the dipping roller 8, the medium 13 is taken up thereby and subsequently transferred to the metering roller 9. The applicator roller 10 which is in direct contact with the metering roller 9 transfers the medium 13 to the surface of the printed sheet which is to be treated.

Because it is hardly possible to prevent the medium 13 from running down over the ends of the applicator roller 10, ductor blades 11 are disposed thereat. The medium 13 running down the ends of the applicator roller 10 is wiped off by the ductor blade 11 and flows back to the storage tank or supply container 7 for reuse. In this way, contamination of the printing machine is prevented and, at the same time, economical use of the medium 13 is enhanced.

The applicator roller 10 is controllable via an impression throw-off which is applied in such a manner that only the applicator roller 10 can be engageable with and retracted from the cylinder 12. Hence, the dipping roller 8, the metering roller 9 and the applicator roller 10

are always in mutual contact. During the application of the medium 13, the rollers 8, 9 and 10 of the lacquering unit 4 are driven via the drive mechanism of the printing machine. The further treatment or processing of the sheets thus occurs, at the operating and printing speed, respectively, of the machine.

When this further or subsequent treatment of the sheets is, for example, not required for a specific portion of the total impression or when the printing machine is stopped for a time, then the lacquering appliance 4 is disengaged from the cylinder 12. In order to prevent the medium 13 from drying on the rollers 8, 9 and 10 during this period of time, a motor 14 which is coupled to the metering roller 9 takes up the driving function and, thus, indirectly also the driving of the dripping roller 8 and of the applicator roller 10 which are in direct contact with the metering roller 9. In this regard the rollers 8, 9 and 10 need not rotate at fully machine speed. Only a few rotations per minute are thus required in order to prevent the drying of the medium 13.

A single-revolution coupling or clutch 24 (FIG. 3), for example, effects the disengagement or decoupling of the lacquering unit 4 from the cyliner 12 when the specific embodiment is one wherein the rubber cloth or blanket has been applied in an abutting manner on the applicator roller.

Another embodiment of the lacquering unit 4 is illustrated in FIG. 2. The dipping roller 8 revolves in the storage tank or supply container 7 filed up with the medium 13, takes up the medium and transfers it to the metering roller 9. A ductor blade 15 is disposed on this metering roller 9 for effecting metered transfer of the medium 13. This metering feature operating in correspondence with a particular format permits the use also of a cylinder 16 interrupted or broken by a channel as an applicator roller. This cylinder 16 is also in direct contact with the sheet-carrying cylinder 12. For effecting disengagement, a single-revolution clutch or coupling 24 (FIG. 3) is used in order that, when the lacquering unit is restarted, the cylinder 16 does not touch down on the sheet at the very place where the channel is located. The drive of the lacquering unit 4 is effected in the same manner as for that of the lacquering unit 4 illustrated in FIG. 1.

The embodiments of this lacquering unit 4 permit the use thereof at all times as another printing unit. Because the applicator roller 10 or the cyliner 16 are rollers covered with a rubber lining or blanket, the possibility is afforded of having an additional impression cylinder and inking unit available, without great expense.

The uncouplability of the three rollers is represented in FIG. 3. The motor 14 is mounted in the side wall 17 located at the drive side of the printing machine, and drives a shaft 19 of the metering roller 9 via a belt 18 and a free-wheeling coupling 20. A shaft 21 of the dipping roller 8 is connected to the shaft 19 via gears 22. Likewise, a shaft 25 of the applicator roller 10 and of the cylinder 16, respectively, is coupled with the shaft 19 of the metering roller 9 via gears 23 and the single-revolution coupling or clutch 24.

The format-related underlay is shown in FIG. 4. Before a rubber blanket 26 is tightened on and around the cylinder 12, a previously calibrated sheet 27 accurately cut to the format being used is laid under. Assurance is thereby afforded that the application of lacquer will occur only in this region.

In FIG. 5, an insert member or filling or loading piece 28 is shown received in a channel 29 formed in the cylinder 16. The insert member 28 which is accommodated to the diameter of the cylinder 16 is fastened in the cylinder channel 29 to the cylinder 16 by a spindle 30 and a screw 31.

As shown in FIG. 6, a lacquer layer 32 applied by the dipping roller 8 to the metering roller 9 is suitably doctored by the displaceably arranged doctor blade 15 in a manner related to the format of the sheet which is to be printed.

There is claimed:

1. In a printing machine, a medium applicator disposed downstream of printing units of the machine in the travel direction of a sheet which has been printed, the applicator having three rollers including a first roller for taking up medium from a supply container, a second roller for metering a quantity of the medium to be applied, and a third roller having the same diameter as that of cylinders of the printing units for transferring the medium, comprising a rubber lining disposed on the third roller for directly applying the medium onto the printed sheet; the three rollers, during application of the medium, being in constant meshing engagement with a sheet-transferring cylinder; means for uncoupling the three rollers from the sheet-transferring cylinder, and separate motor means for driving the three rollers when said rollers are uncoupled.

2. Medium applicator according to claim 1, wherein the third roller is in the form of a cylinder with a continuous surface.

3. Medium applicator according to claim 2 wherein the rubber lining is a rubber cloth applied in abutting manner on the third roller, the third roller having the same diameter as that of the sheet-transferring cylinder, and the third roller being connected by a single-revolution clutch to said sheet-transferring cylinder.

4. Medium applicator according to claim 1, including a ductor blade disposed on at least one of the end faces of the third roller serving to transfer the medium to the printed sheet, said ductor blade being disposed so that when superfluous medium is removed by the ductor blade, the thus removed superfluous medium can flow back into the supply container.

5. Medium applicator according to claim 1, wherein the third roller is in the form of a cylinder having a channel formed therein; and including an insert member received in said channel so as to complete a continuous cylinder.

6. Medium applicator according to claim 1 including a ductor blade disposed on the second roller for ensuring exact format-related metering of the medium.

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United States Patent [19]

Butler et al.

[11] **4,270,483**

[45] **Jun. 2, 1981**

[54] **PRINTING COATER**

[76] Inventors: **Denton G. Butler**, 23 Halladier Pl., Islington, Ontario, Canada, M9B 2H4; **Andrew W. Lester**, 30 Innis Cresc., Richmond Hill, Ontario, Canada, L4C 5K2

[21] Appl. No.: **972,688**

[22] Filed: **Dec. 26, 1978**

[51] **Int. Cl.³** **B05C 11/00**

[52] **U.S. Cl.** **118/46**; 101/217; 118/206; 118/258; 118/262; 118/264; 118/261

[58] **Field of Search** 118/258, 46, 264, 206, 118/261, 262; 101/201, 451, 217

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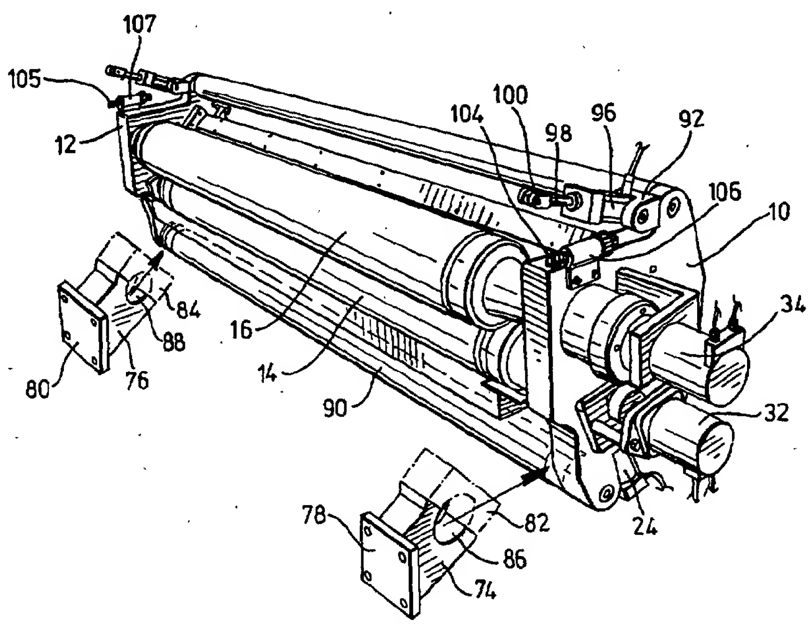
Primary Examiner—Edward C. Kimlin

[57] **ABSTRACT**

An apparatus is provided for attachment to the downstream end of a conventional offset lithographic printing press for in-line coating of the printed work issuing from the press, with water-based polymer coatings, to protect the printing ink as the printed matter sets and hardens. The apparatus includes a pick-up roller which picks up liquid coating composition from a reservoir structure, a cylindrical applicator roller to which the coating composition is transferred, the apparatus being mounted on the frame of the press so that the applicator roller of the apparatus can bear against the blanket roll of the printing press and transfer the coating composition to the blanket roll as the press operates. The apparatus is releasably mounted to the press, and can be pivoted about a lower axis to bring the applicator roll into and out of contact with the blanket roll of the press.

6 Claims, 5 Drawing Figures



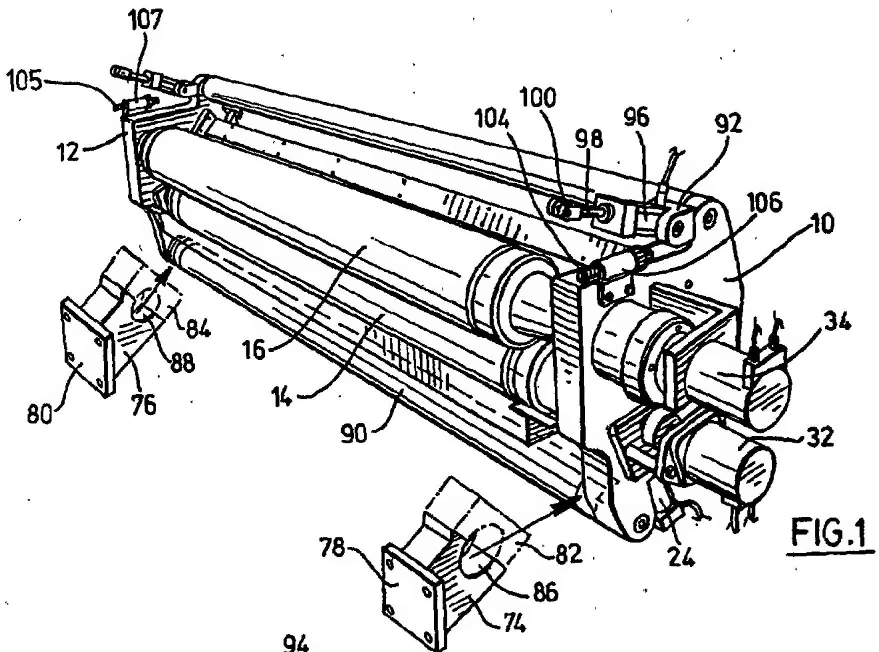

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FIG.1

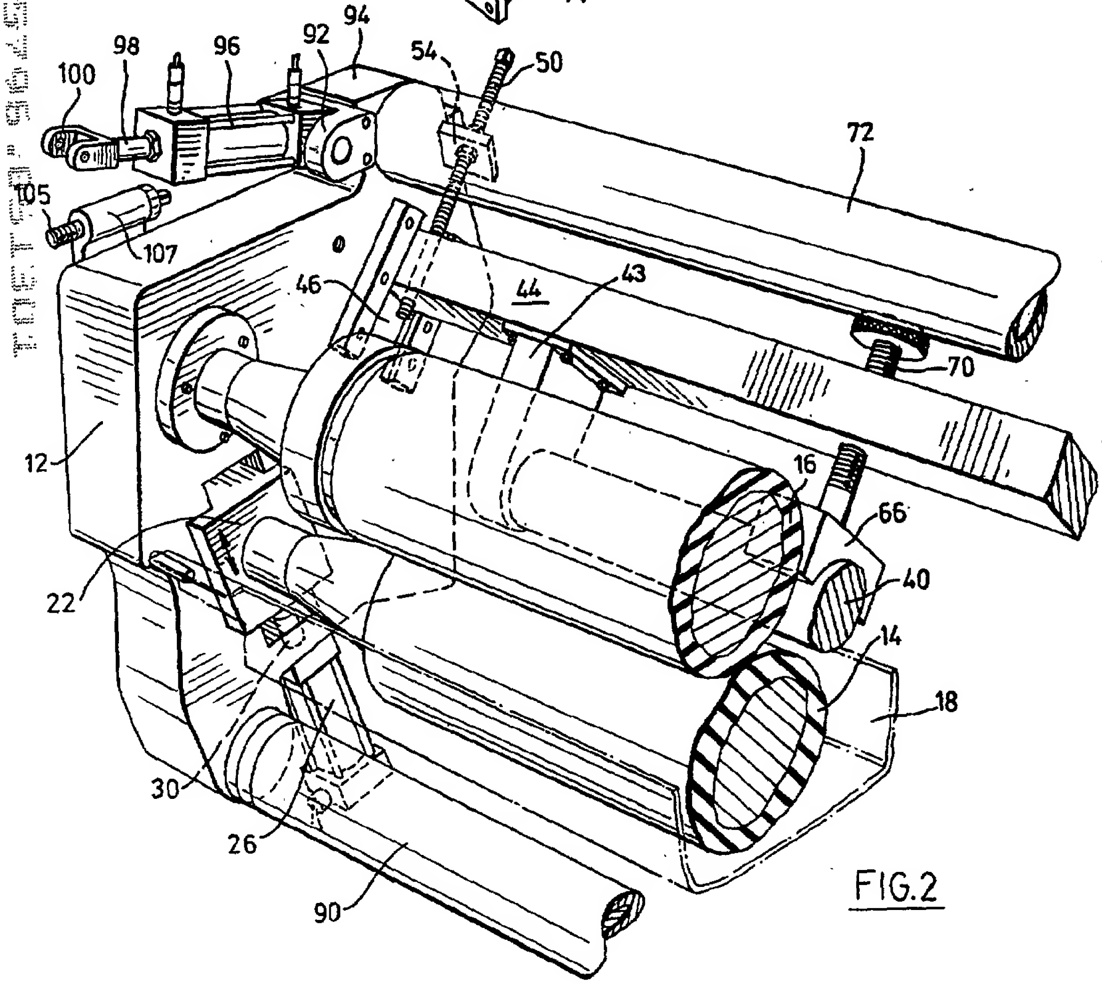
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FIG.2

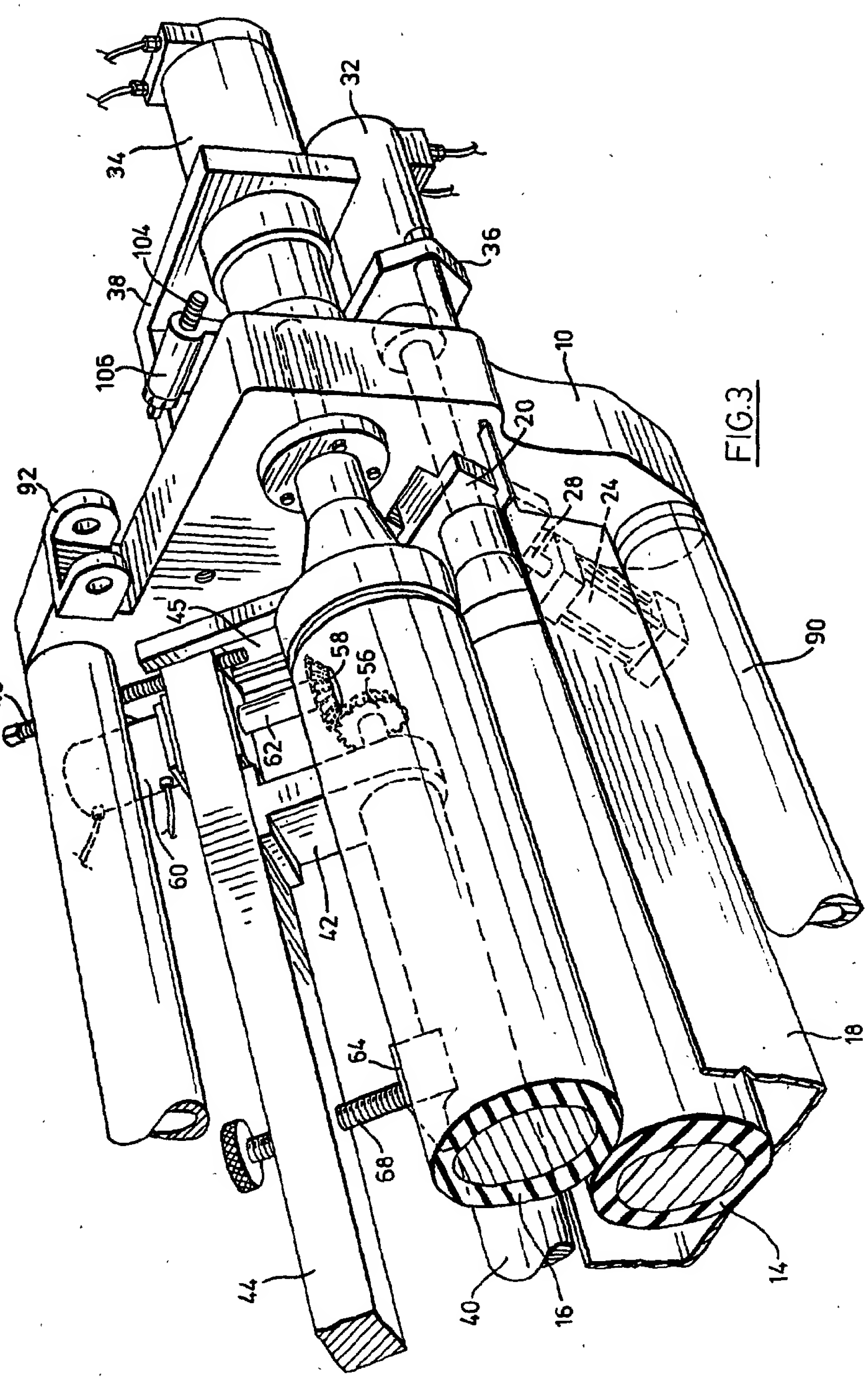
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FIG.3

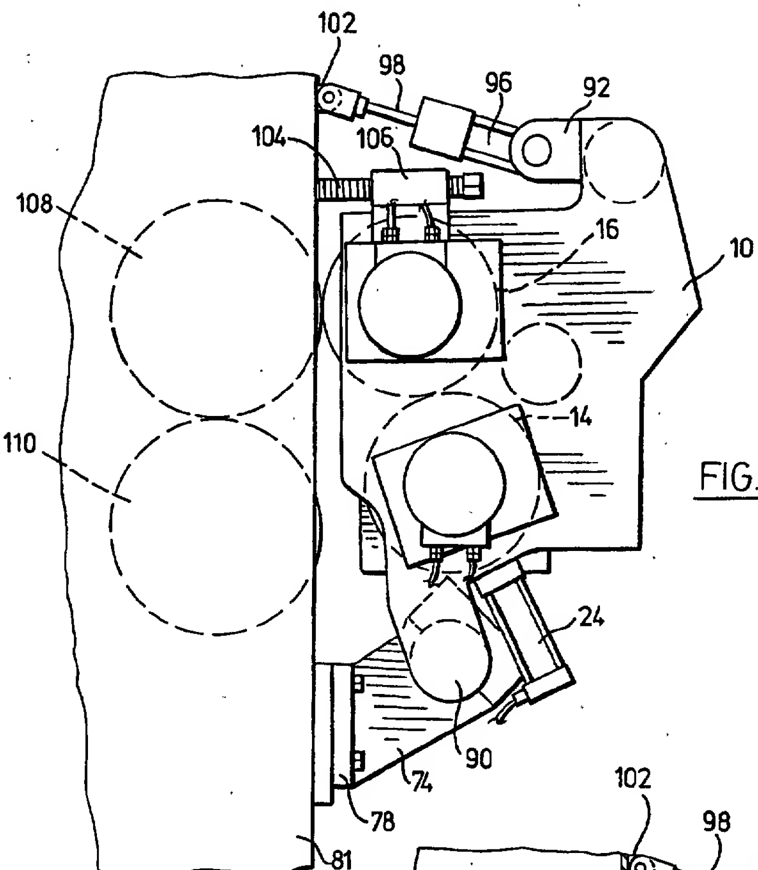
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FIG.4

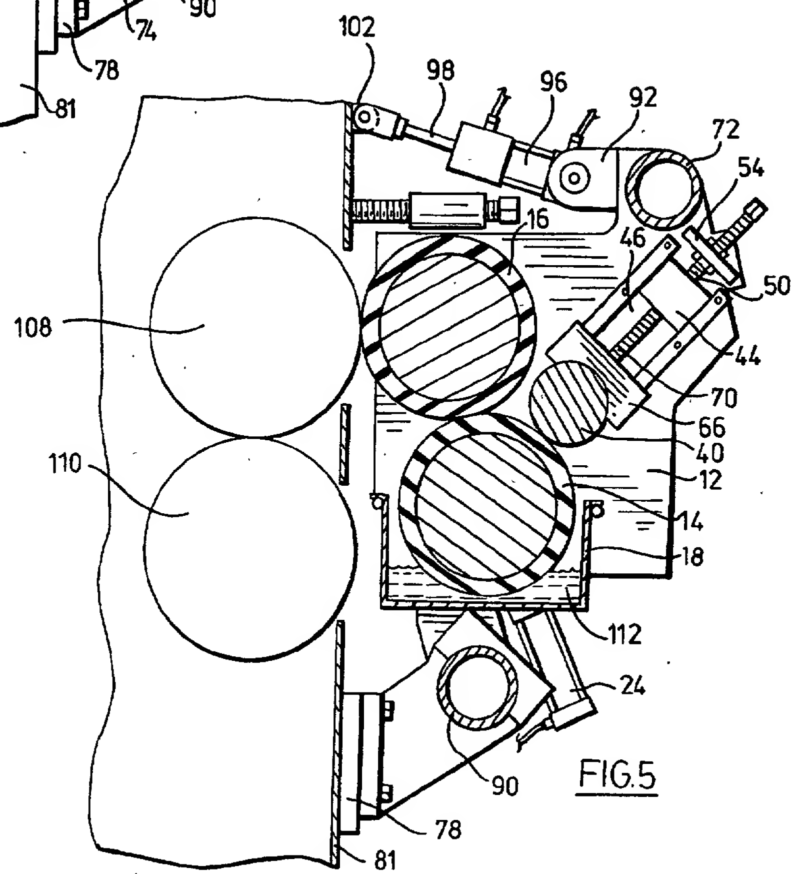
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FIG.5

PRINTING COATER

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to offset lithographic printing, and more particularly to apparatus for attachment to the down-stream end of an offset lithographic printing press, for coating purposes.

In offset lithographic printing, each printing stage includes a plate cylinder, to which the printing plates are fastened tightly around the circumference, the plate cylinder being equipped with superimposed inking, watering and wiping mechanisms. The plate cylinder does not come into contact with the paper to be printed, but transfers the image to an intermediate blanket cylinder, which has a specially composed smooth, rubber blanket surface. The blanket cylinder, having received the impression from the plate cylinder, in turn transfers it, or offsets it, onto the paper or other material, whilst it is being carried around an impression cylinder, located out of contact with the plate cylinder. Lithographic inks are oil-based, and special precautions normally need to be taken to dry the inks after their application to the printed material, as rapidly as possible without spoiling the quality of the printing, so that the printed material can be subsequently handled and stacked without damaging the applied printing.

2. Brief Description of the Prior Art

An alternative to conventional drying of printed sheets issuing from a lithographic printing press, is coating of the printed sheet with a water-borne system, to provide either a gloss or dull coating. Water-borne coatings, applied as an aqueous solution or emulsion, are capable of providing a simple protective barrier for the ink, which eliminates the need for the application of spray powder for drying purposes, and protects the ink from abuse whilst its normal setting and oxidation functions proceed. Much development with water soluble polymers has been undertaken in the last few years, to produce acceptable coatings for this purpose. When properly applied, the film is permeable and permits the passage therethrough of oxygen, to permit the normal setting and drying of the ink. In addition to this function of protecting printing inks after application to permit their proper drying, water-borne coatings can perform a useful decorative function to enhance the appearance of high quality, multi-colour printing work, for example phonograph record sleeves.

If the coating of printed material is conducted in a separate operation, after the material has been removed and isolated from the printing press, the operation is expensive and inconvenient, and does not contribute to the solution of the ink drying problems. It is known to apply water-borne and organic solvent lacquers in a separate operation from the printing, to provide special, decorative finishes. The use of solvent based lacquers introduces fire and explosion hazards.

There is a need in the industry for a simple and economical apparatus for application of water-based polymer coatings to printed material immediately after the printing thereof, i.e. in-line coating with the lithographic offset press.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a novel apparatus for inline coating of printed material issuing from an offset lithographic printing press.

It is a further object of the invention to provide such an apparatus which can be releasably secured to an existing offset lithographic printing press, and operated in conjunction therewith without requiring substantial modification of the printing press itself.

The present invention provides an apparatus for application of coatings to printed material, in the form of an attachment to be applied to the downstream end of a conventional offset lithographic printing press. The apparatus is releasably mountable in position so as to apply a liquid coating composition to the blanket cylinder of the final stage of an offset press, the apparatus including an applicator roller which can bear against the surface of the blanket cylinder and rotate therewith, a pick-up roller which applies coating composition to the applicator roller for transfer to the blanket cylinder, and a reservoir of coating composition in which the pick-up roller runs, to obtain its source of coating material. The entire apparatus is constructed as a unit, for application and use with a standard printing press as and when required, and removable therefrom when not in use. It is merely necessary to disconnect the normal liquid supply train associated with the final stage of the press, without even physically removing it from the press, in order to use the apparatus according to the present invention along with a conventional press.

Thus according to one aspect of the present invention, there is provided an in-line coating apparatus for attachment to and use in conjunction with an offset lithographic printing press which has a final stage including a rotatable blanket cylinder and a rotatable impression cylinder, said apparatus being adapted for continuous surface coating of items printed by said press, said coating apparatus comprising:

a reservoir structure for receiving liquid coating compositions;

a cylindrical pick-up roller adapted to receive on its surface coating composition from said reservoir structure as it rotates;

a cylindrical applicator roller mounted to rotate with its surface contacting the rotating surface of said pick-up roller so as to transfer liquid coating composition from the pick-up roller to the applicator roller;

drive means for rotatably driving at least one of said pick-up roller and said applicator roller;

releasable mounting means for releasably securing said apparatus to the downstream end of said offset printing press, said mounting means being adapted to secure the apparatus to the press with surface contact between the applicator roller and the final stage blanket cylinder of said press.

From another aspect, the present invention provides an offset lithographic printing press having a plurality of liquid applicator stages, each including a rotatable blanket cylinder and a rotatable impression cylinder, said press including an in-line coating apparatus secured to the down-stream end thereof and operable in conjunction with the blanket cylinder of the final, downstream stage thereof, the coating apparatus including:

a reservoir structure for receiving liquid coating compositions;

a cylindrical pick-up roller adapted to receive on its surface coating composition from said reservoir structure as it rotates;

a cylindrical applicator roller mounted to rotate with its surface at one location contacting the rotating surface of said pick-up roller so as to transfer liquid coating composition from the pick-up roller to the applicator roller, said cylindrical applicator roller also mounted to rotate with its surface at the second location contacting the rotating surface of the blanket cylinder of the final stage of the press;

drive means for rotatably driving at least one of said pick-up roller and said applicator roller.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

A conventional offset lithographic printing press has at least two stages, and may have four or five stages, when the machine is used for printing several colours. The final stage of such a printing press normally includes a plate cylinder, a blanket cylinder and an impression cylinder, mounted substantially vertically one above the other, with a varnish trough and a train of vertically mounted rollers from the varnish trough downwardly to the plate cylinder, for applying varnish to the printed work as it proceeds out of the printing press. The apparatus according to the present invention is particularly well suited for securing to a printing press of this type. It is then merely necessary to disconnect the roller train between the varnish trough and the plate cylinder, e.g. by removing or displacing one of the rollers of said train, and the apparatus of the present invention can be used in its stead. The apparatus is equally applicable to a final ink-applying stage of an offset press, in similar manner.

Preferably also, the apparatus according to the invention includes a metering roller mounted adjacent to the surface of the pick-up roller, at a location where its surface carries the coating composition to transfer to the applicator roller, so that the metering roller may limit the quantity of coating composition carried by the pick-up roller. It is of advantage also to make the position of the metering roller adjustable, so that the amount of coating applied can be adjusted thereby.

Also according to a preferred embodiment, the apparatus is pivotally mounted with respect to the frame of the printing machine, and is pivotal about a generally horizontal axis located below the level of the blanket cylinder of the press and the pick-up roller of the coating apparatus. Then the apparatus can be pivoted towards and away from the end of the printing press, to put the applicator roller into contact with the blanket cylinder for operating purposes, and to move the applicator roller out of contact with the blanket cylinder, when it is not required to use the coating attachment according to the invention. Such an arrangement greatly enhances the versatility of the resulting printing press, allowing it to be used in conventional manner as well as in application of coating by the apparatus of the invention.

BRIEF REFERENCE TO THE DRAWINGS

FIG. 1 is a perspective view of an in-line coating apparatus according to the present invention;

FIG. 2 is a detailed perspective view of the first, left-hand end of the apparatus of FIG. 1;

FIG. 3 is a detailed perspective view of the second, right-hand end of the apparatus of FIG. 1;

FIG. 4 is an end view of the apparatus of FIG. 1, taken from beyond the left-hand end thereof;

FIG. 5 is a vertical cross-sectional view of the apparatus of FIG. 4.

In the drawings, like reference numerals indicate like parts.

DETAILED DESCRIPTION OF THE SPECIFIC PREFERRED EMBODIMENT

With respect to the drawings, and especially to FIGS. **1**, **2** and **3** thereof, an in-line coating apparatus especially for applying water-borne liquid coating compositions to printed sheet or web material, comprises a pair of similar end frame members **10**, **12** in which are journalled shafts of the cylindrical pick-up roller **14** and a cylindrical applicator roller **16**, mounted above the pick-up roller **14**. A reservoir structure in the form of an open-topped trough **18** is provided, in which coating liquid may be contained, and extending between the frame members **10**, **12**. The pick-up roller **14** is mounted to rotate in the trough **18**. The applicator roller **16** and the pick-up roller **14** have surface contact near the top of the pick-up roller **14**. The position of pick-up roller **14** is adjustable to a limited extent, towards and away from the applicator roller **16** and relative to the bottom of the trough **18**, by slidable journal blocks **20**, **22** slidably mounted in apertures in respective end frame members **10**, **12**. The journal blocks **20**, **22** are positionally adjustable in end frame members **10**, **12** by means of respective hydraulic cylinders **24**, **26** with pistons **28**, **30** protruding upwardly therefrom and passing upwardly through apertures in frame members **10**, **12** to bear against the underside of the journal blocks **20**, **22**. The cylinders **24**, **26** are connected to a suitable source of hydraulic power, not shown.

The shafts of the pick-up roller **14** and applicator roller **16** are each provided with respective hydraulic motors **32**, **34**, for rotational drive of the rollers. The motors **32**, **34** are mounted in respective structural brackets **36**, **38** protruding axially beyond side frame member **10** and secured thereto.

A cylindrical rotatable metering rod **40** is provided, extending parallel to the pick-up roller **14** and applicator roller **16**, and rotatably mounted in bearing blocks **42**, **43** one at each end of metering rod **40**. The bearing blocks are securely bolted to a mounting bar **44** which at each end is slidably received in slideways **45**, **46** on the inner surfaces of respective end frame members **10**, **12**. The slideways are directed radially towards the pick-up roller **14** so that the proximity of metering rod **40** to pick-up roller **14** is adjustable by adjusting the position of mounting bar **44** in slideways **45**, **46**. To effect this adjustment, screw shafts **48**, **50** are provided, threadably engaging brackets such as **54**, on respective end frame members **10**, **12**, and received in mounting bar **44**. Metering rod **40** is driven for rotation by means of bevel gears **56**, **58** and hydraulic motor **60** with drive shaft **62**, mounted on mounting bar **44**. The metering rod **40** is steadied and guided in its rotation by adjustable guide blocks **64**, **66**, the end, part cylindrical surface of which slidably engages the circumference of rod **40**. The guide blocks **64**, **66** ensure an even coating thickness across the width of the press. They serve to minimize coating thickness variance caused by roller sag along its considerable length, or deflection thereof due to mechanical problems. The guide blocks **64**, **66** are mounted on the end of respective screw threaded bolts **68**, **70** threadably received in apertures in mount-

ing bar 44. Above the mounting bar 44, there is provided a tubular strengthening rail 72 extending between end frame members 10, 12.

The mounting means for releasably securing the coating apparatus to the downstream end of an offset printing press comprises a pair of similar clamps 74, 76 each provided with a plate 78, 80 to be bolted to upright end frames 81 of a printing press (FIGS. 4 and 5). Each clamp 74, 76 has a respective removable block 82, 84 defining a circular aperture 86, 88. There is provided a cylindrical mounting rod 90 on the apparatus, extending between the end frame members 10, 12 at the lowermost part thereof. The mounting rod 90 is received in circular apertures 86, 88 in the clamps to form a pivotal connection of the apparatus to the press at this lowermost part.

At its upper part, the apparatus is connected to the press by means of a pair of length adjustable linkages, one attached to each end of frame member 10, 12. Each linkage comprises a yoke 92 secured to an uppermost protrusion 94 on the respective end frame member 10, 12 (see especially FIG. 2), the yoke 92 having pivotally secured thereto a hydraulic cylinder 96 and piston 98, the end of piston 98 having a bifurcated formation 100 for pivotal securing to a bracket 102 on the end frame 81 of the press. Thus hydraulic cylinder 96 can be pressurized to extend piston 98 and cause pivoting of the coating apparatus relative to the frame 81 of the press, about the inner horizontal axis provided by the mounting rod 90. The forwardmost position of the pivoting movement of the apparatus towards the press frame 81 is limited, to an adjustable extent, by a stop means comprising a pair of bolts 104, 105 threadably received in respective threaded sleeve mounts 106, 107, one at each end frame member 10, 12 at the top surface thereof, the bolts 104, 105 protruding axially towards the end frame 81 of the press.

The mounting and operation of the apparatus of the present invention will be apparent from the foregoing description and particularly with reference to FIGS. 4 and 5 of the accompanying drawings. The apparatus is mounted in position on the end frame 81 of an offset lithographic printing press, the final, downstream stage of which includes a blanket cylinder 108 and impression cylinder 110, between which printed material is fed. The mounting is accomplished using releasable clamps 74, 76 pivotally engaging mounting rod 90, and by connecting bifurcated formations 100 on piston rods 98 to brackets 102. Coating liquid 112 is introduced into trough 18. The relative position of pick-up roller 14, applicator roller 16 and metering rod 40 are adjusted to provide the pick-up and transfer of coating liquid 12 in the desired amount. Hydraulic cylinders 96 are contracted to pivot the apparatus about rod 90 and bring applicator roller 16 into light surface contact with blanket cylinder 108 of the press. The contact pressure is limited by presetting the position of stop bolts 104, 105 in their respective sleeves 106, 107, to engage the end frame 81 of the press at the desired position. This prevents undue pressure on and consequent damage to the surface of the blanket cylinder 108. The various drive motors for the apparatus are activated to drive the rollers etc. at the desired speed to match that of the press. Coating liquid 112 is picked up from trough 18 by pick-up roller 14, metered by rod 40, transferred to applicator roll 16 by surface contact therewith, and thence similarly to the blanket cylinder 108 of the press to coat sheets printed by and issuing from the downstream end of the press. When it is desired to interrupt the application of coating, the hydraulic cylinders 96 may be pressurized to pivot the apparatus about rod 90, clockwise with reference to FIGS. 4 and 5, and bring applicator roller 16 out of surface contact with blanket cylinder 108. The printing press conventionally has a liquid trough and train of smooth surface transfer rollers located above the blanket cylinder and plate cylinder (not shown) thereof, for supply of other liquids such as varnishes to the printed sheet via the blanket cylinder. When the apparatus according to the invention is moved to its operative position shown in FIGS. 4 and 5, the conventional liquid application is rendered inoperative by interrupting the liquid supply roller train thereof. The conventional system can readily be replaced and used when the apparatus of the invention is not to be employed and is pivoted to its inoperative position or removed entirely from the press.

The apparatus according to the present invention thus provides a simple and versatile in-line coating means for use with conventional, standard offset lithographic printing presses. It is well suited for the application of water-based polymer coatings to newly printed work, to protect the ink thereon whilst it sets and hardens. It requires a minimum of modifications to the standard press and easily installed as an "add-on" item. It does not interfere with sheet feed and collection apparatus of the press, and can be used with conventional dryers if desired. Once installed it can be moved to an inoperative position simply and easily without total removal from the press if desired, and the press restored to its full conventional operation.

Whilst a specific preferred embodiment of an apparatus according to the invention has been described and illustrated in detail herein, it will be appreciated that this is for illustrative purposes only and is not to be construed as limiting. Many variations of standard parts, e.g. use of alternative drive means and power actuation means, will readily occur to those skilled in the art. The scope of the invention is defined by the appended claims.

What we claim is:

1. An in-line coating apparatus for attachment to and use in conjunction with an offset lithographic printing press which has a final printing stage including plate, blanket and impression cylinders, said blanket cylinder engaging with said impression cylinder to print a sheet passing between the blanket and impression cylinders, said apparatus being adapted for continuous surface coating of items printed by said press and passing in contact with said blanket cylinder of the final printing stage thereof, the coating apparatus comprising:

a reservoir structure for receiving liquid coating compositions;

a cylindrical pick-up roller adapted to receive on its surface coating composition from said reservoir structure as it rotates;

a cylindrical applicator roller mounted to rotate with its surface contacting the rotating surface of said pick-up roller so as to transfer liquid coating composition from the pick-up roller to the applicator roller;

drive means for rotatably driving at least one of said pick-up roller and said applicator roller;

releasable mounting means to mount said apparatus adjacent the blanket cylinder of said final printing stage of said printing press, said mounting means being effective to secure the apparatus to the press

and including control means for moving the applicator roll independently of said blanket cylinder so that the blanket cylinder remains in engagement with said impression cylinder, between a first, operative position in which said applicator roll is in engagement with the blanket cylinder of the final printing stage of said press and a second, inoperative position in which said applicator roll is disengaged from said blanket cylinder, said control means constituting means permitting said final stage optionally to be used as a printing stage and as a coating stage.

2. The apparatus of claim 1 further including a metering roller mounted adjacent to the surface of the pick-up roller at a location where said surface carries coating composition to transfer to the applicator roller, said metering roller being adapted to limit the quantity of coating composition carried by the pick-up roller.

3. The apparatus of claim 2 wherein the metering roller is positionally adjustable, towards and away from the pick-up roller.

4. The apparatus of claim 3 including adjustment means for adjusting the relative positions of the pick-up roller and the applicator roller, to vary the surface contact pressure therebetween.

5. The apparatus of claim 1 wherein the releasable mounting means is a pivotal mounting means comprising a lower pivot mount for releasably attaching to a lower part of the frame of the printing press, said lower pivot mount being disposed below the pick-up roller and applicator roller, and an upper mount for releasable attachment to a higher part of the frame of the printing press, said upper mount being disposed above the applicator roller and comprising a length adjustable linkage, the length of said linkage being adjustable in a direction towards and away from the end of the printing press to cause pivoting of the apparatus relative to the printing press about said lower pivot mount, thereby bringing the applicator roller into and out of operative contact with the blanket cylinder of said printing press.

6. The apparatus of claim 5 also including an adjustable stop means mounted on the upper part thereof, adapted to engage the end frame of the printing press to limit the pivoting movement of the apparatus towards the end of the printing press when the applicator roller is brought into contact with the blanket cylinder.

* * * * *

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United States Patent [19]

Frazzitta

[11] **Patent Number: 4,779,557**

[45] **Date of Patent: Oct. 25, 1988**

[54] COATER FOR A SHEET FED PRINTING PRESS

[76] Inventor: Joseph Frazzitta, 279 Cherry Pl., East Meadow, N.Y. 11554

[21] Appl. No.: 77,699

[22] Filed: Jul. 27, 1987

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 902,782, Dec. 4, 1986, abandoned, which is a continuation of Ser. No. 748,974, Jun. 26, 1985, abandoned.

[51] Int. Cl.[4] B05C 1/02

[52] U.S. Cl. 118/46; 118/224; 118/249; 118/262

[58] Field of Search 118/46, 224, 249, 262; 101/419; 427/428

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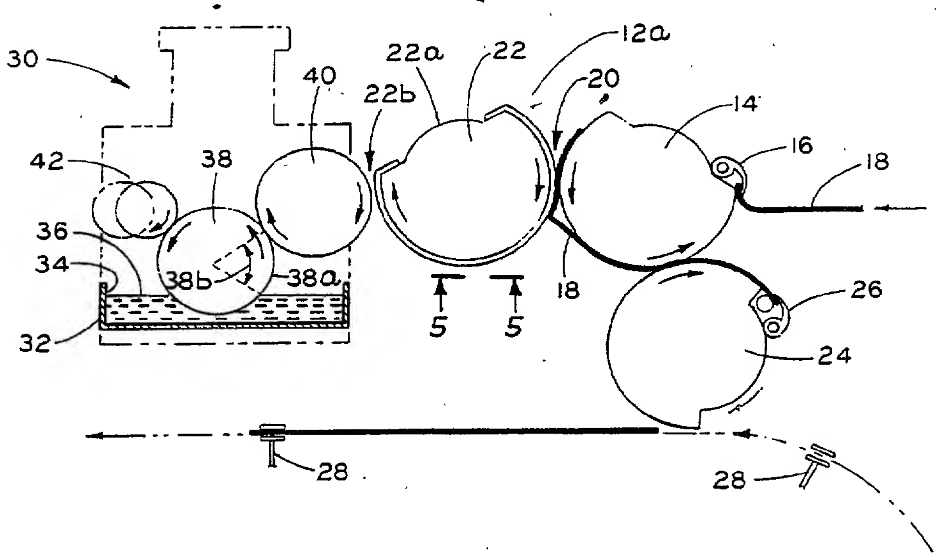
Primary Examiner—Evan K. Lawrence

[57] **ABSTRACT**

A coater for an offset printing press in which the last printing station, i.e., the blanket cylinder roller with its associated sheet-handling grippers, is converted to coating service, such that a pick-up roller, after an ascending arcuate path not exceeding 80°, transfers a liquid coating to an applicator roller rotating in an opposing direction to the blanket cylinder surface which coats the individual imprinted sheets and the liquid coating itself serves as a lubricant permitting said opposing directions of rotation and grippers of said blanket cylinder roller maintain proper handling control of the sheets during the coating thereof. Limiting the arcuate path of 80° obviates reverse flow of the liquid coating on the pick-up roller.

4 Claims, 3 Drawing Sheets



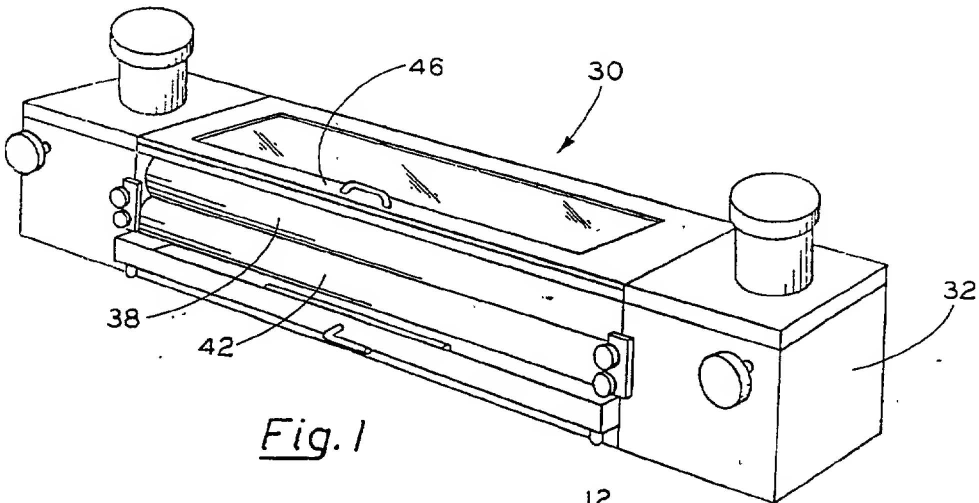


Fig. 1

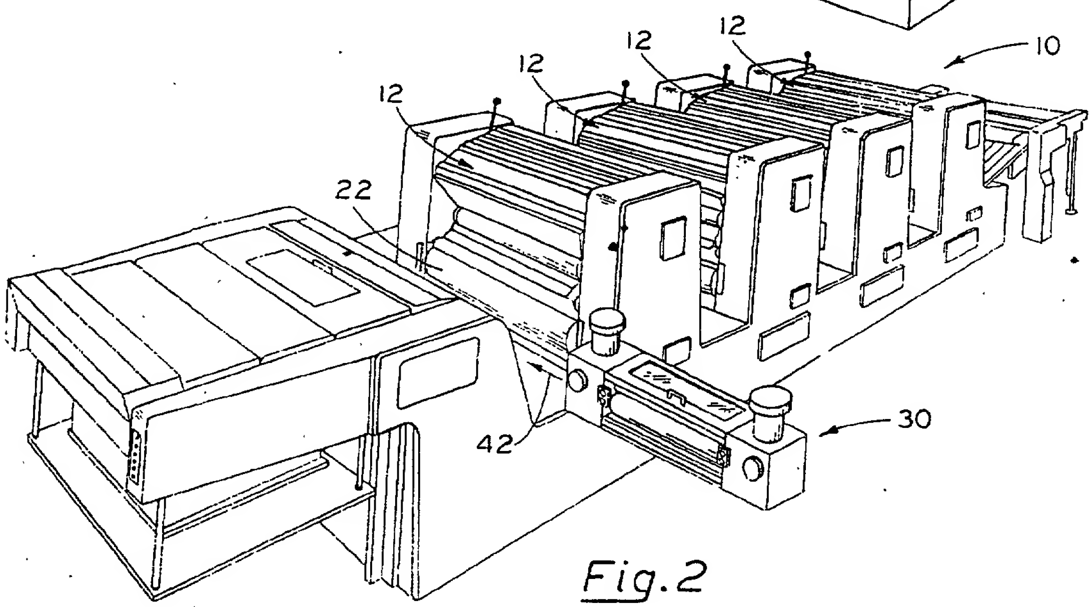


Fig. 2

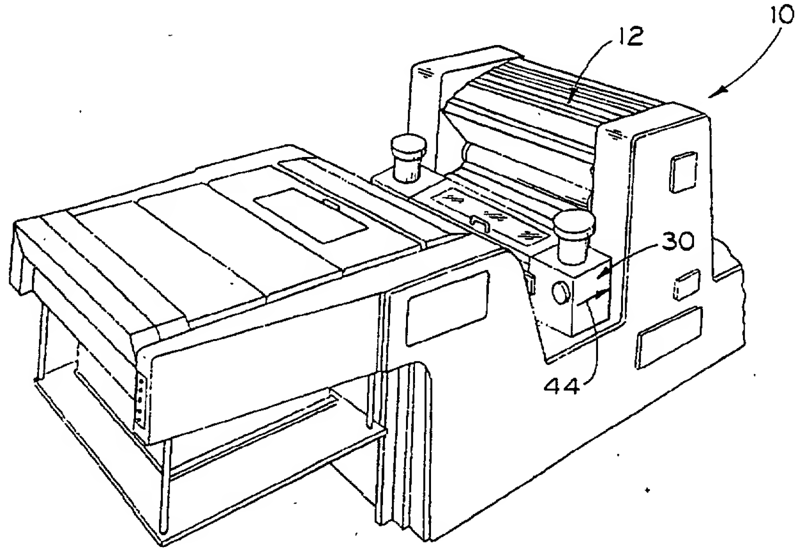


Fig. 3

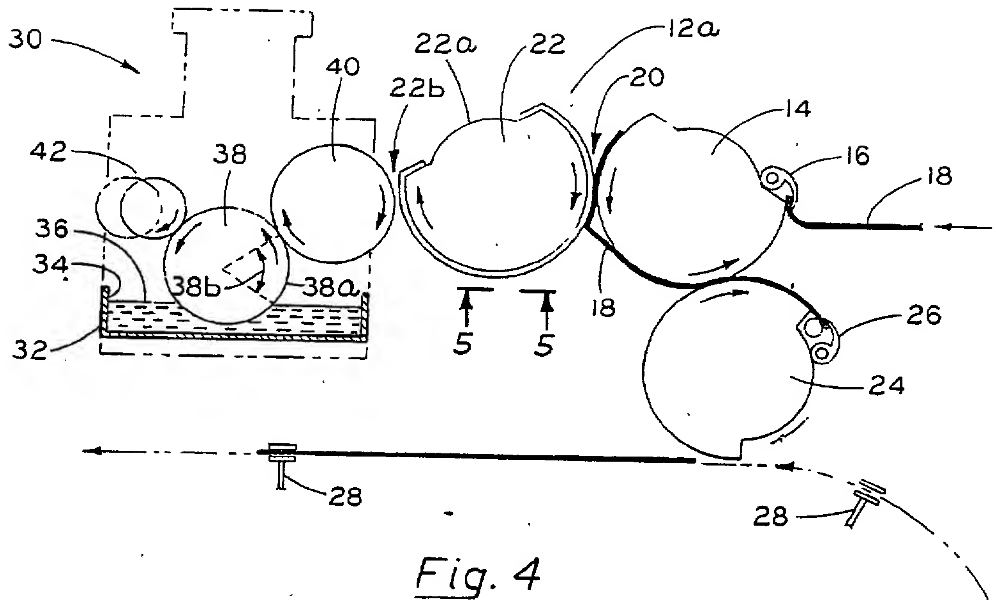


Fig. 4

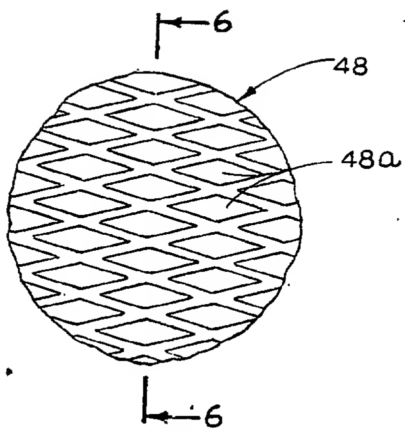


Fig. 5

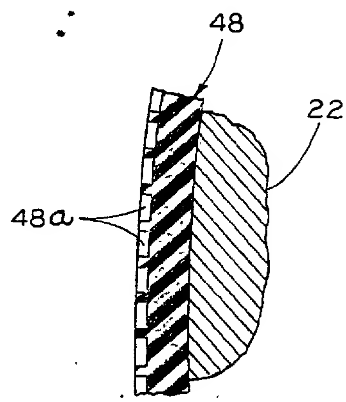


Fig. 6

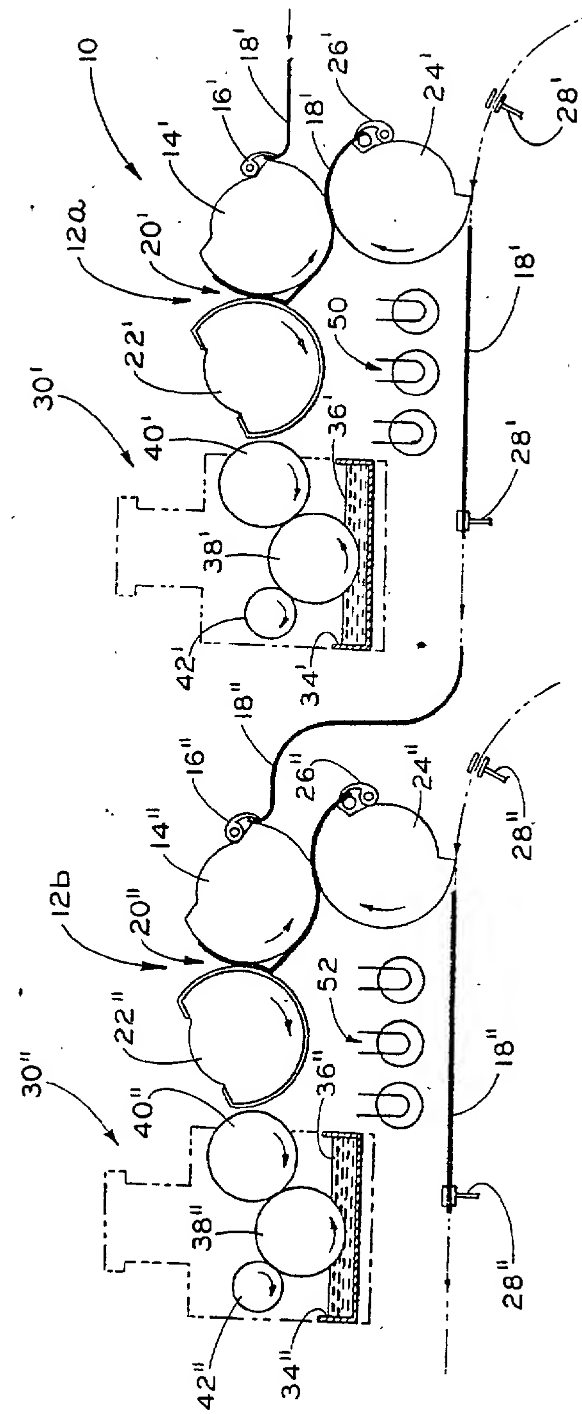


Fig. 7

COATER FOR A SHEET FED PRINTING PRESS

This is a continuation-in-part of application Ser. No. 902,782, filed Dec. 4, 1986, now abandoned, which is a continuation of application Ser. No. 748,974, filed June 26, 1985, now abandoned.

The present invention relates to improvements in coating individual sheets during the printing thereof in an offset printing press, and more particularly to a coating device for an offset printing press that effectively applies a aqueous, ultra-violet or other liquid coating to each imprinted sheet, in turn, without adversely affecting the printing operation of the printing press.

Applying liquid coating to printed material is, of course, already well known, and achieved using coating devices of well-known construction and modes of operation, as exemplified by the coating devices of U.S. Pat. Nos. 3,257,226, 3,029,780, and 3,951,102. These known coaters however are not noteworthy in their effectiveness and, most important, are not compatible with the operation of a standard offset printing press, to which the within invention is applied, as distinguished from a so-called web press. That is, the known coaters are restricted to use with said web press in which a continuous web is fed through the press and a significant degree of tension can therefore be exerted on the web as it is being printed. This ability to apply tension to a continuous web greatly facilitates the application of a coating thereto, whereas applying the same degree of tension to individually fed sheets of an offset printing press, an operating parameter which usually is required during the coating of the individul sheets, may inadvertently cause disengagement of the individual sheet from the grippers and thus seriously adversely affect the printing operation of the standard offset printing press.

Broadly, it is an object of the present invention to provide a coater for an offset printing press handling individually fed sheets overcoming the foregoing and other shortcomings of the prior art. More particularly, it is an object to utilize to advantage the sheet-handling apparatus of the printing press and to combine therewith a surface coating means, so that coating is effectively applied to the imprinted sheets while they are under the handling control of the printing press.

A coater demonstrating objects and advantages of the present invention is applied to a printing press of the type in which individual sheets are imprinted during passage through a nip between a cooperating blanket cylinder roller and an impression cylinder, said nip defining each of plural printing stations operatively arranged in series relation with each other. More particularly, the coater includes an operational mode that contemplates using the last encountered blanket cylinder roller for coating service, rather than printing, and operatively arranging same for counterclockwise direction rotation. Located adjacent the blanket cylinder roller is a storage container for a supply of a liquid coating to be applied to the individually printed sheets having a pick-up roller disposed with a lower portion in the liquid coating supply and operatively arranged for counterclockwise rotation for moving the liquid coating adhered to the surface thereof through an ascending arcuate path of less than 180 degrees, this restricted path being effective to obviate reverse direction flow of said liquid coating along said pick-up roller surface. Completing the rotating components is an applicator roller operatively arranged in contact with the pick-up roller along said arcuate path and also in contact with the blanket cylinder roller, said applicator roller being operatively arranged for clockwise rotation for maximizing the amount of liquid coating transferred thereto from the counterclockwise rotating pick-up roller at the respective surfaces of each which are either in light surface contact with each other or slightly spaced apart. In this way the imprinted sheets are individually coated during passage between the opposite direction rotating applicator and blanket cylinder rollers, said liquid coating serving as a lubricant permitting said opposing direction movements in said applicator and blanket cylinder rollers.

The above brief description, as well as further objects, features and advantages of the present invention, will be more fully appreciated by reference to the following detailed description of presently preferred, but nonetheless illustrative embodiments in accordance with the present invention, when taken in conjunction with the accompanying drawings, wherein:

FIG. 1 is a perspective view of a coating device which, in accordance with present invention, is used in cooperating conjunction with a blanket cylinder roller of a standard offset printing press;

FIG. 2 is also a perspective view and illustrates how the coating device of FIG. 1 is moved into its operative position with the blanket cylinder roller of said printing press;

FIG. 3 is a partial perspective view illustrating the operative position of said coating device at a printing station of said printing press;

FIG. 4 is a simplified side elevational view in longitudinal cross section illustrating structural details of the printing press and coating-applying cooperating rollers of the within invention;

FIG. 5 is a partial view as seen along lines 5—5 of FIG. 4 illustrating, on an enlarged scale, structural details of an elastomeric blanket of the blanket cylinder roller;

FIG. 6 is a view in cross section, taken along lines 6—6 of FIG. 5, showing further structural details of the surface of said blanket cylinder roller; and

FIG. 7 is a view similar to FIG. 4, but illustrating the application of two coatings to the sheet fed material at two printing stations.

Illustrated in FIG. 2 and partially in FIG. 3, will be understood to be a standard sheet fed offset printing press, generally designated 10. As is well understood, said standard offset printing press 10 includes plural printing stations, individually and collectively designated 12, at which a separate color is transferred to individual sheets providing a multi-color result. More particularly, and as will be explained in greater detail subsequently, on multi-color presses of which the printing press 10 will be understood to be an example, the transferring of a sheet from one printing station 12 to the next printing station located in line therewith, while keeping said sheet in exact register, is accomplished by means of transfer cylinders whose grippers are timed to take hold of the sheet before they are released by the previous cylinder gripper. For purposes of the within invention, it is important to note that the aforesaid operation of a standard offset printing press differs significantly from a so-called web press, in which a continuous web is fed through the press and a significant degree of tension can therefore be exerted on the web as it is being printed. This ability to apply tension to a continuous web greatly facilitates the application of a coating

thereto, whereas applying the same degree of tension to individually fed sheets of an offset printing press, an operating parameter which usually is required during the coating on the individual sheets, may inadvertently cause disengagement of the individual sheet from the grippers and thus seriously adversely affect the printing operation of the standard offset printing press.

An important contribution of the present invention therefore is the achievement of applying a coating to individually fed sheets of a standard offset printing press, such as press 10, without adversely affecting the printing operation of said press

The manner in which, in accordance with the present invention, individual fed sheets of an offset printing press are effectively coated, can best be appreciated by the simplified cross sectional view of FIG. 4, to which figure reference should now be made. In accordance with the present invention, the last encountered printing station 12, designated 12a in FIG. 4, is incorporated as part of the within inventive coating operation. Printing station 12a, as is well understood, is defined by an impression cylinder 14 having standard cnstructed and operating grippers 16 which effectively grip, in turn, the leading edge of each imprinted sheet 18. Rotation of the impression cylinder 14 carries the gripped sheet 18 to the nip 20 of said impression cylinder 14 and a cooperating blanket cylinder 22. When used for printing, the blanket cylinder 22 prior to the nip 20 receives an ink image from a printing plate (not shown) and effectively transfers this ink image to the sheet 18. In accordance with the present invention, however, the blanket cylinder 22 is not used for printing service, but is used for effectively applying a liquid coating to the individually fed sheets 18, said coating typically being an appropriate chemical for blocking adverse effects of ultra-violet rays or other aqueous coating, or may even be an acrylic water based coating to provide a gloss or otherwise enhance the appearance of the imprinted sheet. The coating may also accelerate the drying of the printing ink applied to the sheet.

Before describing how the liquid coating is applied, it is helpful to complete the description of the operation of the components of the printing press at station 12a. This operation is completed by a transfer cylinder 24 having grippers 26 which in a well understood manner engage the sheet 18 as it exits from the nip 20 and effectively transfers each sheet 18 to sheet-gripping devices 28 of a conveyor which delivers each sheet to a point of discharge.

Thus far what has been described, except for the use at station 12a of the blanket cylinder 22 for coating rather than printing service, is well understood and does not form an essential part of the within invention. The contribution of the within invention, which will now be described, consists of the coating device, shown in isolated perspective in FIG. 1 and generally designated 30 therein, which cooperates with and has an operative position in relation to the blanket cylinder 22, as shown in FIGS. 2, 3, and as now will be described in detail.

Still referring to FIG. 4, the coating device 30 includes a housing 32 which bounds a compartment 34 for the storage of a supply of the liquid coating 36 to be applied to the individual fed sheets 18. Appropriately journaled for rotation in the lower portion of the supply 36 is a pickup roller 38, which, because the blanket cylinder roller 22 is journaled for rotation in a clockwise direction, is itself journaled for rotation in a counterclockwise direction, the reasons for which different directions of rotation will soon be apparent. During counterclockwise rotation of the pickup roller 38, however, a liquid coating which adheres to its surface is raised through an ascending path 38a and is transferred therefrom before the path 38a is as long as 180 degrees. As a result, a liquid which is picked up on the surface of the pickup roller 38 does not travel through an arcuate path of such length that there is reverse flow (i.e., flow in a direction which is opposite the rotational direction of roller 38) in the picked-up liquid coating. Rather, at a point of ascending movement which does not exceed to only 80 degrees as noted by the angle 38b, surface contact is established with said pickup roller 38 by an applicator roller 40 appropriately journaled for rotation in a clockwise direction. Thus, at the surface contact established with the pickup roller 38, the clockwise rotation of applicator roller 40 is in a direction which most effectively transfers a maximum amount of liquid coating from said pickup roller 38 to its surface. On the side of the applicator roller 40 opposite from the pickup roller 38, the surface of the applicator roller is located in a range from being in light contact with the surface of the blanket cylinder 22 to a slight gap 22b spaced therefrom. This light contact or slightly spaced apart relationship of the surfaces of the rollers 40 and 22 is necessitated by the opposing directions of rotation of these rollers. Nevertheless, it has been found in practice that the liquid coating, which may consist of the chemical sold under the trademark SUN CURE by General Printing Ink, division of Sun Chemical of New Jersey, effectively serves as a lubricant which permits the opposing directions of rotation while at the same time there is an effective transfer of the liquid coating from the surface of the applicator roller 40 the surface of the blanket cylinder 22 even, under some operating conditions, across the slight gap 22b. Naturally, there is no transfer in the gap area 22a of the blanket cylinder 22 which gap area must be provided in order to register with the gap area that has to be incorporated in the construction of the impression cylinder 14 because of the grippers 16.

Completing the construction of the coating device 30 is a metering roller 42 which in an appropriate manner is mounted for movement in a clearance position shown in phantom perspective in FIG. 4 into an operative condition shown in full line in FIG. 4, in which latter position it makes contact with the pickup roller 38. The metering roller 42 is only in contact with the pickup roller 38 when the apparatus is running in a standard mode, but said metering roller 42 is disengaged from the pickup roller 38 when the latter is running in a reverse mode (i.e., counterclockwise), thus giving the operator the option of running in either the standard or reverse mode.

Referring now to FIGS. 2 and 3, it is noted for completeness' sake that at the last encountered printing station, which, according to the present invention, is to be used for coating rather than printing service, there is exposure of and therefor ready access to the blanket cylinder 22 of this station. The coating device 30 will be understood to be on appropriate support apparatus, not shown, so that is can be effectively moved from a clearance position to the side of the printing press 10 as shown in FIG. 2, into an operative in line position in the direction 42, said operative position being more particularly illustrated in FIG. 3. In the operative position of FIG. 3 it will then be understood that preferably using pneumatic cylinders which engage the device 30 in its

operative position, that said device is effectively moved in the direction 44 towards the blanket cylinder 22 so that light contact or the slight gap 22*b* is established with said blanket cylinder 22 and the previously referred to applicator roller 40 of the device 30.

As is perhaps best illustrated in FIG. 1, the coating device 30 includes, in addition to the components thereof previously described, a hinged top cover 46, which when opened provides access for making any repairs or replacements to the pickup roller 38, applicator roller 40 or metering roller 42, as well as to the motor which is operatively associated with the metering roller 42 for moving it from its clearance position into contact with the pickup roller 38 and also for the motor which is operatively engaged to drive the pickup roller 38 through rotation. Access through the opening of the cover 46 to the compartment 34 is also necessary for replenishing the liquid coating supply 36.

Special note is made in FIGS. 5 and 6 of a possible elastomeric blanket which is recommended for use for the blanket cylinder 22 to enhance its coating-applying efficiency. As shown in these figures, appropriately mounted about the periphery of the blanket cylinder 22 is an elastomeric blanket 48 having a pattern of surface depressions, individually and collectively designated 48*a*, which are effective in receiving acrosss the nip or gap 22*b* that previously was described as having been established between the applicator roller 40 and blanket 22, a maximum amount of the liquid coating 36 for transfer to the individual fed sheets 18 at the nip 20.

In the apparatus as illustrated and described in connection with FIGS. 2 and 3, the direction of the individual fed sheets 18 are from right to left, and thus the rotation direction of the blanket cylinders 22, including said cylinder at the coating station 12*a*, are in a clockwise direction. It should be readily appreciated, however, that if the delivery of the individually fed sheets 18 were from left to right, that the rotation direction of the blanket cylinders would be in a counterclockwise direction, and that the rotation directions of the moving components of the coating device 30 would then be in the opposite direction than that illustrated and described in connection with FIG. 4. Accordingly, it is to be understood that the within invention, and the claims defining same, contemplate both directions of rotation of the rotating components practicing said invention.

Referring now to FIG. 7, it will be further understood that the within invention contemplates applying a coating to the individual fed sheets 18 at two stations, rather than just one station, as illustrated and described in connection with FIGS. 1–6. A two-station coating process is particularly advantageous in order to achieve a high lamination appearance on the imprinted sheets 18. That is, as understood, in order to presently achieve a high gloss on an imprinted sheet, it is necessary to use a mechanical process in which a plastic film is laminated to the printed substrate. In accordance with the present invention, it is now possible to achieve such a result chemically, rather than mechanically. To do this, and as illustrated diagramatically in FIG. 7, the printing press 10 is modified to the extent of constructing an additional coating station 12*b* down the line from station 12*a* of FIG. 4. In all other respects, except as noted, the structure already described in connection with FIG. 4 is the same, and this similarity is indicated in FIG. 7 by the use of the same reference numerals with a single prime of coating station 12*a*, and a double prime at coating station 12*b*. The only structure added to the setup of FIG. 7 are infrared lamp dryers 50 and 52 located as illustrated at the coating stations 12*a* and 12*b*, respectively. The dryers 50 and 52 will be understood to be of conventional construction and mode of operation and, in lieu thereof, good results can also be achieved using convection hot air units.

Coating station 12*a* is preferred to coat the individual fed sheets 18 with an acrylic water base emulsion which is applied over the sheet 18 previously printed with an oil-based ink. Exposure of the sheet 18*a* to the infrared lamp dryers 50 achieve surface drying thereof. Previously, the drying of the aqueous or ultraviolet coating on the sheet 18*a* invariably resulted in a nominal gloss level in the printed sheet. As a result, it was standard practice to mechanically laminate a plastic film to the printed sheet to obtain a high gloss level in the surface thereof. In accordance with the system of FIG. 7, however, the mechanical lamination is eliminated and in its place there is provided in accordance with the present invention a second coating station 12*b* which preferably applies a high gloss photochemical epoxy resin coating to each individually fed sheet 18″ which is transferred from station 12*a* to station 12*b*.

From the foregoing description of the system of FIG. 7, it should be readily appreciated that the process described and illustrated achieves a high gloss appearance in the imprinted sheets 12 that is the same as that achieved by mechanical lamination of plastic film and does so in much less time and without the equipment and apparatus necessary for a mechanical lamination process. The process of FIG. 7 utilizes already existing stations of a multi-station offset standard printing press modified in the manner herein illustrated and described to provide coating, rather printing service.

In the foregoing description, the reference to imprinted sheets and the application thereto of the within inventive coating methods is intended to have specific reference to chemically achieving an ultra high gloss surface over wet ink, an achievement which in the trade would be aptly called "wet trap in line", wherein the "wet trap" signifies achieving a dried ultra high gloss surface trapping wet inks on the paper substrate, and "in line" signifies achieving same during the normal offset printing process rather than, as now done in the prior art, mechanical bonding a plastic film to the printed sheet as a plastic film to the printed sheet as a separate operation.

However, the invention is not limited to a "wet trap in line process", and it is to be further understood that a latitude of modification, change and substitution is intended in the foregoing disclosure, and in some instances some features of the invention will be employed without a corresponding use of other features. Accordingly, it is appropriate that the appended claim be construed broadly and in a manner consistent with the spirit and scope of the invention herein.

What is claimed is:

1. A coater for a printing press of the type in which individual sheets are imprinted during passage between a cooperating blanket cylinder roller and an impression cylinder defining each of plural printing stations operatively arranged in series relation with each other, said coater comprising said last encountered blanket cylinder roller used for coating service rather than printing operatively arranged for clockwise direction rotation, a storage container for a supply of a liquid coating to be applied to said individually printed sheets, a pick-up roller having a lower portion disposed in said liquid

coating supply operatively arranged for counterclockwise rotation for moving said liquid coating adhered to the surface thereof through an ascending arcuate path not exceeding 80 degrees to obviate reverse direction flow of said liquid coating along said pick-up roller surface, and an applicator roller operatively arranged in contact with said pick-up roller to receive said liquid coating thereon adjacent the end of said arcuate path not exceeding 80° and also either in contact with, or spaced by a slight gap from, said blanket cylinder roller, said applicator roller being operatively arranged for clockwise rotation for maximizing the amount of liquid coating transferred thereto from said counterclockwise rotating pick-up roller at the respective surfaces of each in contact with each other and effectively further transferring said liquid coating thereon to said opposing direction moving surface of said blanket cylinder roller operatively arranged at a clearance position therefrom preparatory to said liquid coating being applied to said imprinted sheets at said last encountered printing station, said liquid coating serving as a lubricant permitting said opposing direction movements in said applicator and blanket cylinder rollers.

2. A coater for a printing press of the type in which individual sheets are imprinted during passage between a cooperating blanket cylinder roller and an impression cylinder defining each of said plural printing stations operatively arranged in series relation with each other, said coater comprising said last encountered blanket cylinder roller used for coating service rather than printing operatively arranged for counterclockwise direction rotation, a storage container for a supply of a liquid coating to be applied to said individually printed sheets, a pick-up roller having a lower portion disposed in said liquid coating supply operatively arranged for clockwise rotation for moving said liquid coating adhered to the surface thereof through an ascending arcuate path not exceeding 80 degrees to obviate reverse direction flow of said liquid coating along said pick-up roller surface, and an applicator roller operatively arranged in contact with said pick-up roller to receive said liquid coating thereon adjacent the end of said arcuate path not exceeding 80° and also either in contact with, or spaced by a slight gap from, said blanket cylinder roller, said applicator roller being opratively arranged for counterclockwise rotation for maximizing the amount of liquid coating transferred thereto from said clockwise rotating pick-up roller at the respective surfaces of each in contact with each other, and effectively further transferring said liquid coating thereof to said opposing direction moving surface of said blanket cylinder roller operatively arranged at a clearance position therefrom preparatory to said liquid coating being applied to said imprinted sheets at said last encountered printing station, said liquid coating serving as a lubricant permitting said opposing direction movements in said applicator and blanket cylinder rollers.

3. A pair of coaters for a printing press of the type in which individual sheets are imprinted during passage between a cooperating blanket cylinder roller and an impression cylinder defining each of plural printing stations operatively arranged in series relation with each other, said coaters comprising two sets of sequentially encountered blanket cylinder rollers used for coating service rather than printing operatively arranged for clockwise direction rotation, and for each said coater and its cooperating blanket cylinder roller, a storage container for a supply of a liquid coating to be applied to said individually printed sheets, a pick-up roller having a lower portion disposed in said liquid coating supply operatively arranged for counterclockwise rotation for moving said liquid coating adhered to the surface thereof through an ascending arcuate path not exceeding 80 degrees to obviate reverse direction flow of said liquid coating to receive said liquid coating thereon adjacent the end of said arcuate path not exceeding 80° and also either in contact with, or spaced by a slight gap from, said pick-up roller along said arcuate path and also in contact with said baanket cylinder roller, said applicator roller being operatively.arranged for clockwise rotation for maximizing the amount of liquid coating transferred thereto from said counterclockwise rotating pick-up roller at the respective surfaces of each in contact with each other and effectively further transferring said liquid coating thereon to said opposing direction moving surface of said blanket cylinder roller operatively arranged at a clearance position therefrom preparatory to said liquid coating being applied to said imprinted sheets at each said encountered printing station, said liquid coating serving as a lubricant permitting said opposing direction movements in said applicator and blanket cylinder rollers.

4. A pair of coaters for a printing press of the type in which individual sheets are imprinted during passage between a cooperating blanket cylinder roller and an impression cylinder defining each of plural printing stations operatively arranged in series relation with each other, said coaters comprising two sets of sequentially encountered blanket cylinder rollers used for coating service rather than printing operatively arranged for counterclockwise direction rotation, and for each said coater and its cooperating blanket cylinder roller, a storage container for a supply of a liquid coating to be applied to said individually printed sheets, a pick-up roller having a lower portion disposed in said liquid coating supply operatively arranged for clockwise rotation for moving said liquid coating adhered to the surface thereof through an ascending aruuate path not exceeding 80 degrees to obviate reverse direction flow of said liquid coating along said pick-up roller surface, and an applicator roller operatively arranged in contact with said pick-up roller to receive said liquid coating thereon adjacent the end of said arcuate path not exceeding 80° and also either in contact with, or spaced by a slight gap from, said blanket cylinder roller, said applicator roller being operatively arranged for counterclockwise rotation for maximizing the amount of liquid coating transferred thereto from said clockwise rotating pick-up roller at the respective surfaces of each in contact with each other and effectively further transferring said liquid coating thereon to said opposing direction moving surface of said blanket cylinder roller operatively arranged at a clearance position therefrom preparatory to said liquid coating being applied to said imprinted sheets to each said encountered printing station, said liquid coating serving as a lubricant permitting said opposing direction movements in said applicator and blanket cylinder rollers.

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United States Patent [19]

Bird

[11] **Patent Number: 4,841,903**

[45] **Date of Patent: Jun. 27, 1989**

[54] **COATING AND PRINTING APPARATUS INCLUDING AN INTERSTATION DRYER**

[75] Inventor: **John W. Bird**, Westport, Conn.

[73] Assignee: **Birow, Inc.**, Westport, Conn.

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[22] Filed: **Jun. 24, 1987**

[51] **Int. Cl.⁴** **B05C 11/00**

[52] **U.S. Cl.** **118/46**; 101/201; 101/217; 118/66; 118/258; 118/262; 118/264; 118/602; 427/258; 427/382; 427/411

[58] **Field of Search** 118/46, 66, 602, 258, 118/264, 262; 101/201, 217; 427/382, 258, 411

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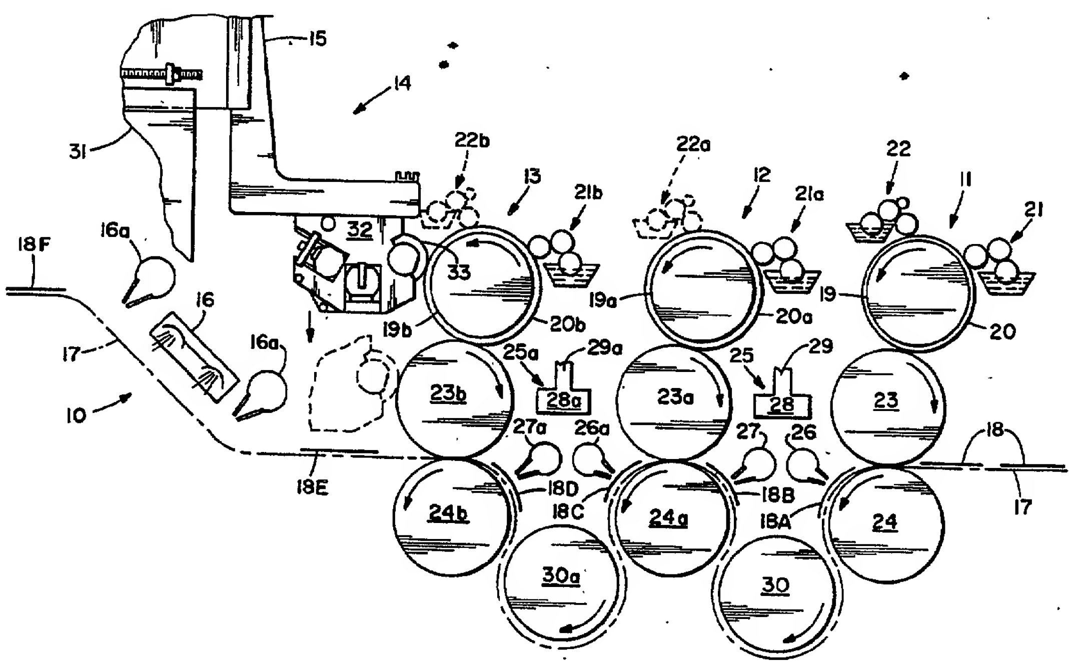
Primary Examiner—Bernard Pianalto

Attorney, Agent, or Firm—Perman & Green

[57] **ABSTRACT**

An offset lithographic printing method and machine having a plurality of in-line liquid application stations, at least one of which is an ink image-printing station for printing lithographic ink images on a suitable receptive copy sheet, and at least the final downstream liquid-application station is a coating application station for printing a protective, and/or aesthetic coating over selected portions of, or over the entire ink image-printed surface of the copy sheet. The present method and apparatus involves the placement of a drying station between liquid application stations to evaporate volatile solvent or vehicle from the ink images and/or to solidify the liquid coating applied at upstream stations before the application of a continuous or spot coating thereover at the next downstream coating station.

5 Claims, 1 Drawing Sheet



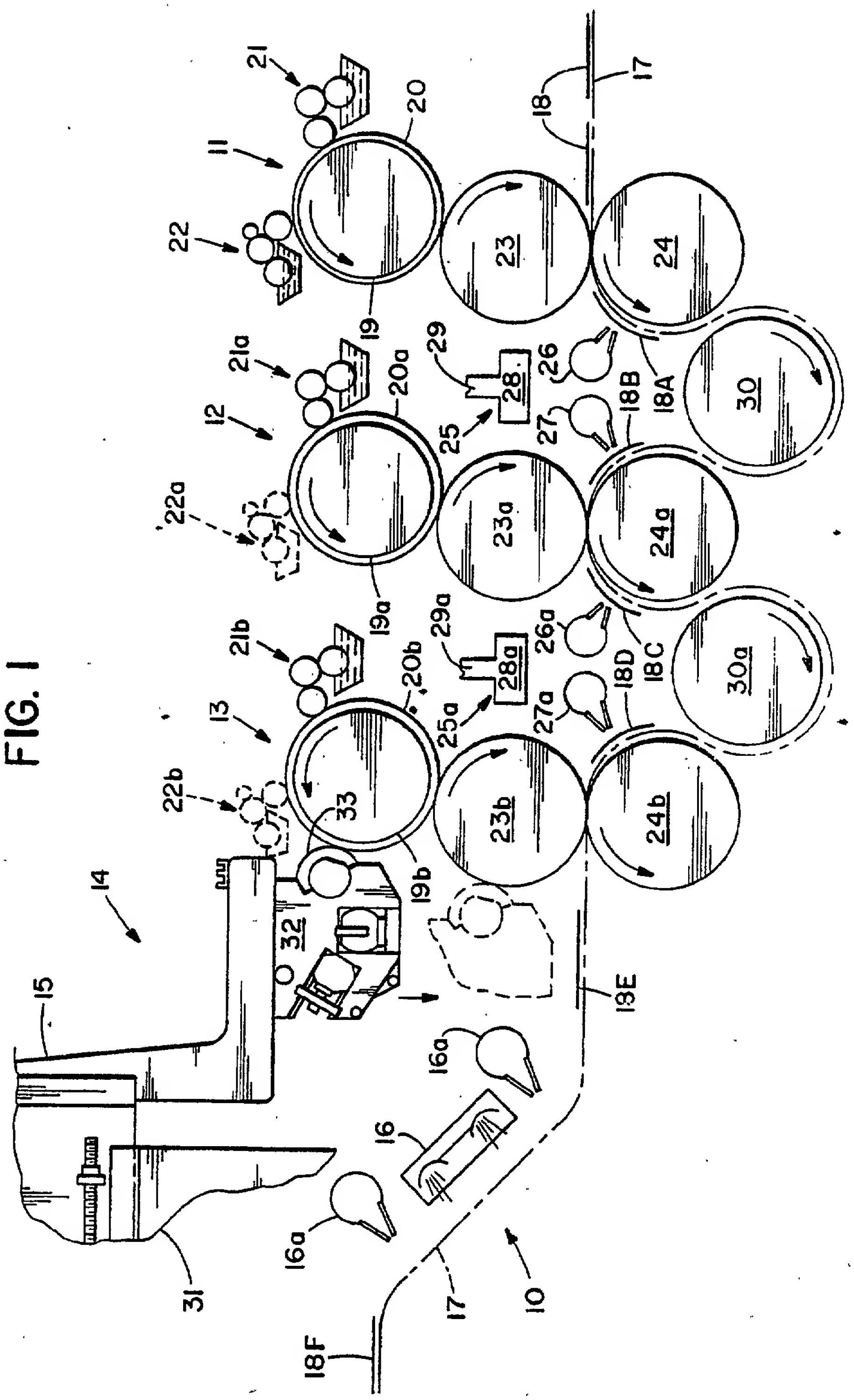


FIG. 1

COATING AND PRINTING APPARATUS INCLUDING AN INTERSTATION DRYER

BACKGROUND OF THE INVENTION

Conventional lithographic offset printing machines or presses comprise one or more image-printing stations each having a plate cylinder to which is fastened a thin hydrophilic, oleophobic printing plate having image areas which are oleophilic and hydroprobic and background areas which are oleophobic and hydrophilic. The plate surface is continuously wetted with aqueous damping solution, which adheres only to the background areas, and is then inked with oleoresinous ink composition which adheres only to the image areas of the plate as wet ink. The ink is offset-transferred to the rubber surface of a contacting blanket cylinder, and then retransferred to the receptive surface of a copy web or a succession of copy sheets, such as of paper, where the ink gradually hardens or cures by oxidation after passing through a final drying station located downstream of the final liquid application station where the volatile solvent is evaporated from the ink composition of the images.

Since image-curing is gradual, it is conventional to spray the printed copies with starch or other "stilting" powder before the copies are stacked. This prevents sticking of the uncured ink images to adjacent copies and also permits the circulation of air for the oxidation-curing process.

In cases where cost is not a factor and/or where the aesthetic advantages of a protective supercoating are desired, it is known to provide the printing machine with a downstream coating station having a blanket cylinder associated with a coating application unit for the application of an overall protective coating over the entire printed area of the copy sheets or web.

This also avoids the necessity of powdering the printed images. Reference is made to U.S. Pat. No. 4,270,483 for its disclosure of such an apparatus. The coating unit of U.S. Pat. No. 4,270,483 is pivotally-associated with the blanket cylinder for movement between coating and non-coating or retracted positions. Reference is also made to my copending U.S. patent application, Serial No. 65,954, filed on even date herewith.

Protective coating compositions also improve the appearance of printed documents, particularly high quality, multi-color copies such as posters, product brochures, etc., by providing glossy or matte finishes over the entire image-printed surface or over selected image-printed portions thereof such as photographs, product illustrations, etc. Selected area coating, spot coating or perfect registration over predetermined limited printed areas of the copies is advantageous from a cost standpoint since the coating compositions are relatively expensive and the volume required is reduced if the coating is only printed in registration where desired. Also, spot coating is frequently used as a means for highlighting certain portions of the printed copies such as company name or logo, product illustrations, photographs, etc.

While the in-line application of a protective or aesthetic coating over the offset-printed images on a succession of copy sheets will prevent the dried but uncured printed images from sticking to adjacent copy sheets, the relatively wet condition of the printing ink composition and its solvent and/or diluent content, at the time that the coating composition is applied thereover, and the presence of water from the dampening system in the copy sheets, produces a visible change in the appearance of the portions of the coating overlying the printed images during the evaporation of the solvent, diluent, water, etc., whereby, for example, a glossy-surfaced protective coating acquires a flat, matte or non-glossy surface, particularly in areas overlying the dried and cured printed images, and even the affected areas are not uniform in appearance depending upon the colors and/or surface areas of the underlying printed images. For example, printed colored photographs, half-tone illustrations, and the like, which are intended to be emphasized or heightened in appearance, such as by the application of glossy spot coatings thereover, undergo loss or degradation in the uniformity of their appearance and their color during the drying of the copy sheets.

Also, in cases where the protective or aesthetic coating is only spot-applied, such as over printed photographs, product illustrations, etc., the images printed on other surface areas of the copy sheets remain exposed and can stick to adjacent copy sheets unless stilting powder is applied, as discussed herein before.

The speed of operation of conventional offset printing and coating machines makes it impossible to apply successive continuous and spot coatings to a succession of copy sheets because the second coating will not adhere properly to the first coating while the latter is still wet, and/or the second coating will undergo degradation or loss of gloss during drying of the underlying coating.

These defects are of substantial importance in cases where the additional expense of one or more coatings is justified by the desired results, i.e., promotional posters, artwork, product containers, record jackets, videocassette boxes, etc. The defects, i.e., uneven surface appearance of the coating(s), detract from the appearance of the underlying images or photographs, particularly in the case of multi-colored images or photographs and are due to the presence of residual volatile solvents, diluents, water, etc., within the oleoresinous inks of the images or photographs, and the presence of water in the copy sheets, at the time that the first coating is applied thereover, and/or to the presence of volatile solvents, diluents or water within the first coating or undercoating at the time that the second coating is applied thereover. The application of a top coating over the printed images and/or over a first coating retards the volatile solvent, diluent or water against escape in the final drying station, but it eventually migrates into the top coating during the final drying and gradual curing of the ink images over a period of several hours time, resulting in a loss of perfection in the surface finish of the top coating.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a novel printing and coating method and apparatus for the in-line application of one or more protective or aesthetic coatings over imaged subject matter offset-printed onto each of a succession of copy sheets while avoiding the usual degradation or loss of uniformity of the surface appearance of areas of the coating(s) applied over the printed images and/or over underlying coated areas.

It is another objective of the present invention to enable the in-line application of a second protective or aesthetic coating, such as a glossy-finish spot coating, over a first protective coating, such as a continuous matte-finish coating, while avoiding the problems of poor adhesion and degradation or loss of glossy surface appearance of the second coating.

Essentially, the present invention is concerned with providing unblemished coated lithographic copies of the types desired in cases where the additional expense of supercoatings is justified by the desired results.

The present method and apparatus provides for the in-line drying of lithographic ink images, including photographic multi-color reproductions, and/or the drying of first continuous or spot coatings, printed or applied at one liquid application station before the application of a continuous or spot coating over said ink images or over said continuous spot coating at the next downstream liquid application station by interposing an in-line drying station between said one and next liquid application stations in order to more completely dry the ink images or first coating prior to the application of a final coating thereover, whereby the eventual drying of said final coating results in a substantially perfect surface finish

The oleoresinous inks conventionally used to print lithographic copies generally comprise a mixture of oxidizable drying oils, such as safflower oil or linseed oil, a compatible resin binder material, such as a phenolic resin or a varnish, pigment such as carbon black, drying agents, and a volatile solvent such as mineral spirits, or other solvent for the resin and oil. The printed copy sheets also contain some water from the dampening system. Drying of the images occurs in two stages, namely evaporation of the volatile solvent in the first stage to form the relatively dry, tacky printed images, and oxidation-curing of the oleoresinous printed composition which requires several hours time and results in the final non-sticky, smear-resistant printed images. The present invention is concerned with first-stage drying or solvent/water evaporation prior to the application of a supercoating over the printed images

The coating compositions conventionally-used to apply protective or aesthetic coatings over printed lithographic images are aqueous solutions, dispersions or emulsions of water-dispersible or water-soluble film-forming binder materials, such as acrylic resins, hydrophilic colloids, vinyl alcohol, etc. Also, coating compositions free of volatile solvents or vehicles are commonly used, such as resin precursor compositions which are polymerizable or curable by exposure to ultraviolet or other radiation. Such compositions are based upon liquid acrylic monomers or pre-polymers, or photopolymers and photoinitiators, cross-linking agents and/or other conventional ingredients. Both solvent-applied and solvent-free coating compositions can produce microporous coatings which are permeable to oxygen to hasten the curing of the oleoresinous inks. While they are also permeable to the volatile ink solvents, diluents and water, the escape of these volatiles mars the appearance of the surface finish of the coatings, as discussed supra.

The second problem, pertinent to the embodiment of drying between coating stations, relates to the reduced receptivity of wet undercoatings for supercoatings applied thereover, producing uneven, discontinuous or spotty supercoatings having "holidays" or areas which have not accepted the supercoating.

The novel method and apparatus of the present invention overcomes these problems by drying the ink-imaged and/or undercoated copy sheets prior to the application of the undercoating over the ink-printed images and/or prior to the application of the supercoating over the undercoating, whereby substantially-perfect coatings having excellent surface properties, such as gloss, are produced.

DESCRIPTION OF THE DRAWING

FIG. 1 is a vertical cross-sectional view, through the final three liquid application stations of an offset printing machine, illustrating the interposition of in-line drying stations between the last two liquid application stations and a final downstream liquid application station which is a coating-application station.

DETAILED DESCRIPTION OF THE DRAWING

Referring to the drawing, FIG. 1 illustrates a downstream portion of an offset printing machine **10** comprising three liquid application stations **11**, **12** and **13**, a coating apparatus **14** according to aforementioned copending application Serial No. 65,954 filed June 24, 1987, comprising a coating carriage **15**, a final radiation drying station **16** including air knives **16a**, and a continuous copy sheet conveyor means **17** which moves a succession of copy sheets **18** through the printing machine.

The first liquid application station **11** is a conventional offset image printing station comprising a plate cylinder **19**, to which is clamped an imaged lithographic printing plate **20** carrying oleophilic image areas, such as words, photographs, etc. on an oleophobic, hydrophilic background. The conventional clamping means permits some degree of lateral or axial adjustment and some degree of wrap-around or circumferential adjustment of the plate **20** relative to the plate cylinder **19**. Plate cylinder **19** is associated with a dampening system **21** for wetting the entire hydrophilic background surface of plate **20** with aqueous dampening fluid, and with an inking system **22** for selectively inking the image areas of the plate **20** with liquid oleoresinous ink composition containing a volatile organic solvent

The inked plate **20** is rotated against the ink-receptive surface of a blanket cylinder **23**, to which the wet ink images are offset or transferred, and the blanket cylinder **23** is rotated against a copy sheet **18**, passed in the nip between the blanket cylinder **23** and an impression cylinder **24**, to transfer the wet ink images to the copy sheet **18** and form an image-printed copy sheet **18A**. Some water from the dampening system is also transferred to the surface of the copy sheet **18A**. Sheet **18A** is conveyed, imaged face up, through a **25** first drying interstation **25**, comprising a pair of spaced, elongate air knives **26** and **27** and a vapor-extraction unit **28** containing an intake fan and a outlet conduit **29** which conveys the volatile vehicle vapors to a recovery unit, to the atmosphere or for **30** other safe disposal.

As illustrated, the printed copy sheets **18A**, are conveyed by grippers past the first air knife **26**, under transfer cylinder **30** and past the second air knife **27**, to form dried printed copy sheets **18B** which move into the next liquid application station **12**.

The air knives **26** and **27** and the extraction unit **28** are conventional elements normally used as final drying elements on printing and coating machines of different types. Knives **26** and **27** are elongate tubular elements provided with an elongate narrow slot formed by op-

posed, converging walls. Heated air is circulated through the tubular elements under pressure and is expelled from the elongate slot as a concentrated narrow band of high speed hot air which is directed against the ink-printed copy sheets 18A to evaporate the volatile solvent and water therefrom to release solvent and water vapor which is withdrawn by the extraction unit 28. Substantial drying is produced by the first air knife 26, and the second air knife 27 preferrably is included, as illustrated, to insure complete drying prior to the entry of the copy sheets 18B to the next liquid application station.

In the apparatus of FIG. 1, the second liquid application station 12 can be either another ink printing station, such as for printing ink of a second color, or it can be a first coating station Thus the various elements of station 12 are numbered similarly to those of station 11 but including the suffix a.

Where station 12 is another ink printing station, the first drying interstation 25, upstream therefrom, functions only as a supplemental drying station and can be excluded or disconnected.

Where station 12 is a first coating application station, the first drying interstation 25 is a critical component of the present invention. In such case, the inking system 22*a* of station 12 is withdrawn, as shown by means of broken lines, and the dampening system 21*a* is converted to a dampener coater system by providing a continuous supply of the desired coating composition to the supply pan thereof, i.e., an aqueous dispersion of a film-forming binder material containing in the case of matte-finish coatings, a diffusion filler such as silica or the like.

Generally, where the station 12 is a first coating station, the top roll 19*a* will be a plate cylinder having a full plate 20*a* for the application of continuous coatings to the intermediate blanket cylinder 23*a* or transfer cylinder and then to the dried ink-printed copy sheets 18B to form continuous coated printed copy sheets 18*c*. However, if desired, plate cylinder 19*a* may have a spot-receptive plate or relief plate 20*a* for the transfer of spot coatings to the intermediate blanket cylinder 23*a* and then to predetermined areas of the printed copy sheets 18B to form spot-coated printed copy sheets 18C.

Most commonly, the first coating will be a complete or continuous coating of a composition providing a matte non-glossy finish or a utility (semi-gloss) finish, and the second coating will be a spot coating of a composition providing a glossy finish to highlight predetermined areas of the printed, coated copies.

The coated printed copy sheets 18C exiting the first coating station 12 are conveyed by grippers, coated side up, through the second drying interstation 25*a*which is similar to the first drying station 25 and comprises a similar pair of spaced elongate air knives 26*a* and 27*a* and a similar extraction unit 28*a* and exhaust outlet conduit 29*a*.

The line of forced hot air from the first knife 26*a*, across the width of the copy sheets, substantially dries the first coating by evaporating the water vehicle therefrom, after which the dried, coated copy sheets 19D are conveyed by transfer roll 30*a* to the second air knife 27*a* to insure complete drying of the first coating prior to the entry of the coated printed copy sheets 18D into the final coating station 13 which includes the coating-application apparatus of the copending application, in the illustrated embodiment, but which may be a conventional coating station.

In cases where the first and/or second coating composition is free of volatiles and solidifies by polymerization curing, the drying interstation 25*a* and/or downstream drying station 16 will contain a suitable radiation source such as ultraviolet lamps.

The coating application station 13 also can be similar to the inking station 11 and first coating station 12 with respect to the plate cylinder 19*b* supporting a printing plate dampening system 21*b*, inking system 22*b*, blanket cylinder 23*b* and impression cylinder 24*b* since, in a conventional offset printing machine having a plurality of liquid application stations, all of the stations are generally similar but use different printing plates to image different areas of the same copy sheet with different colored inks. The present apparatus, requiring at least one coating-application station, and modifies at least the final downstream inking station to convert it permanently or intermittently to a coating-application station as shown by FIG. 1 or, alternatively, as illustrated by U.S. Pat. No. 4,270,483 discussed hereinbefore.

Plate 20*b* is an offset relief printing plate, preselected areas of which are raised above the background, generally referred to as "relief spots" Such spots are sized and positioned to correspond to areas of the image-printed copy sheets 18D which it is desired to selectively coat.

The adjustable coating apparatus 14 is mounted onto the frame 31 of the printing machine for extension of the coating carriage 15 into the liquid application station 13 for adjustable coating association with either the coating plate cylinder 19*b* or the coating blanket cylinder 23*b*, as desired.

The preferred coating application apparatus 14 includes a coating carriage 15 which is horizontally adjustably, in the machine direction, for movement between retracted or passive position and extended or active position, and also vertically adjustable for movement between the levels of the plate cylinder and the blanket cylinder as shown by means of broken lines. Moreover, the coating carriage 15 comprises a horizontally-adjustable coating applicator unit 32 which is movable in the machine direction between different extended coating positions to move the coating applicator roll 33 into coating association with printing and blanket cylinders which are not in vertical alignment, as disclosed in detail in my aforementioned copending application.

Thus, the coating carriage 15 and the applicator unit 32 are adjusted in the final coating station 13 to associate applicator roll 33 with either the spot relief plate 20*b* on printing roll 19*b*, for the printing of spot coatings, or with the blanket roll 23*b*, for the application of continuous coatings onto the dried, coated, printed copy sheets 18D, to form double-coated printed copies 18E. Copies 18E are transported by grippers past a final downstream radiant dryer 16 and air knives 16*a*, to evaporate the water vehicle from the second coating and form final copies 18F which are stacked to permit final curing of the oleoresinous printing ink.

The essential novelty of the present invention resides in the interposition of a drying station, such as 25 and 25*a*, between an ink printing station and a coating station, and preferably also between coating stations on machines having a plurality of coating stations, in order to substantially completely evaporate the volatile solvent or vehicle from the printed ink images, and evaporate any residual dampening water from the printed copy sheets, before the application of a spot or continuous coating thereover, and preferably to substantially

completely solidify and dry the first coating such as by irradiating to polymerize or by evaporating the volatile solvent, vehicle and/or water from the coated, printed copy sheets before the in-line application of a second spot or continuous coating over the first-applied coating, as illustrated.

In operation, a succession of copy sheets 18 is automatically gripped by the conveyor means 17 and transported through one or more ink printing stations 11 into printing contact with one or more ink blanket rolls 23 to print images, such as of different colors, on predetermined areas of each copy sheet, using conventional oleoresinous inks containing volatile organic solvent(s). At each ink-printing station 11, an offset printing plate 20 is fastened to a plate cylinder 19, moistened with water/chemical dampening fluid by means of dampening unit 21 and inked by means of inking unit 22. The ink is selectively received by the image areas of the plate 20, where some water dampening solution is picked up by the ink, transferred to the surface of the blanket cylinder 23 and re-transferred to the upper surface of a copy sheet 18 passed in the nip of cylinder 23 and impression cylinder 24. At this point, the ink images on each imaged copy sheet 18A still contain the volatile organic solvent and some water dampening solution which migrates into the copy paper.

Rather than moving the inked copy sheets 18A directly from a printing station 11 to a coating station 12, as is conventional in the art, the present method and apparatus provides for intermediate or interstation drying of the inked copies to evaporate the volatile organic solvent and water dampening solution from the ink images and copy paper to form solvent-free copies 18B prior to the application of a protective and/or aesthetic coating thereover.

In the embodiment of FIG. 1 the ink-printed copies 18A are moved through an interstation drying station 25 by directing the path of the copy sheets down under a transfer cylinder 30 and up over the coating impression cylinder 24a of the coating station 12. The drying of the copy sheets is accomplished by one or more high velocity hot air knife drying elements, such as 26 and 27 shown in FIG. 1, which heat the ink image, sufficiently lowering the solvent vapor pressure while the high velocity air scrubs the vapor from the surface to evaporate substantially all of the volatile organic solvent and water and form substantially solvent-free copies 18B before the copies 18B pass in the coating nip at coating station 12.

The evaporated solvent and moisture is drawn into the solvent extraction unit 28 by an exhaust fan 31 and removed from the ambient atmosphere by conduit 29 for safety purposes.

On machines having a single coating application station, such as station 12 or station 13 of FIG. 1, the solvent-free copies 18B are moved through said coating station 12 or 13 to receive either a continuous or a spot coating to form coated, printed copy sheets 18C which are transported to the final downstream drying station 16, 16a. On machines having two coating stations 12 and 13 used for the application to two superposed coatings, either of which may be spot or continuous, matte or glossy, the dried, printed copy sheets 18B are moved through the first coating station 12 to form coated, printed copy sheets 18C which are moved through the second interstation drying station 25a to form dried coated copy sheets 18D. Sheets 18D are moved through the second coating station 13 and on through the downstream drying station 16, 16a.

After curing for several hours, the coated, printed copies 18F are found to be free of the surface defects of copy sheets printed and coated in similar manner but in the absence of interstation drying.

While the present specification and drawing refer to a continuous copy sheet conveyor means 17 carrying automatic grippers, it will be clear to those skilled in the art that most printing and coating machines convey the copy sheets by means of automatic grippers present on each of a series of contacting cylinders, such as the impression cylinders 24, 24a and 24b and the interposed transfer cylinders 30 and 30a of FIG. 1.

It is to be understood that the above described embodiments of the invention are illustrative only and that modifications throughout may occur to those skilled in the art. Accordingly, this invention is not to be regarded as limited to the embodiments disclosed herein, but is to be limited as defined by the appended claims.

What is claimed is:

1. In a continuous in-line offset lithographic printing machine for printing and coating a continuous succession of receptive copy paper sheets, comprising a plurality of liquid application stations, each comprising a plate cylinder for supporting a lithographic printing plate and including means for supplying oleous printing composition to oleophilic image areas on the water-coated surface of a said printing plate supported thereon, a blanket cylinder for receiving said printing composition and water from said plate cylinder and for transferring said printing composition and water to a succession of individual receptive copy paper sheets, and an impression cylinder forming a nip with said blanket cylinder through which said individual receptive copy paper sheets are passed to receive printing composition and water from said blanket cylinder, at least one said liquid application station being an upstream ink printing station for the transfer of printing composition in the form of ink images containing a volatile vehicle onto said succession of copy sheets, and at least one said liquid application station being a downstream coating station for the application of a printing composition in the form of a continuous or spot coating of liquid composition over the ink-imaged surface of said copy sheets, means for feeding said succession of individual receptive copy paper sheets through the nips of said blanket and impression cylinders of said liquid application stations, and a final downstream drying station for drying or otherwise solidifying said coated copy paper sheets, the improvements which comprises an intermediate in-line drying station positioned after each of said liquid application stations, each said drying station comprising means for directing forced hot air against the ink printed copy paper sheets to effect the evaporation of water and the volatile vehicle from the ink images printed on said copy paper sheets prior to the entry of the ink-imaged copy paper sheets into the next liquid application station including into said coating station.

2. A printing machine according to claim 1 having two adjacent downstream coating stations, characterized by the presence of another intermediate in-line drying station positioned in-line therebetween to effect the solidification of the coating applied at the first coating station prior to the entry of the coated copy sheets into the second coating station.

3. A printing machine according to claim 1 in which said coating station comprises a coating application assembly which is adjustably supported for coating association with either the plate cylinder, for the application of spot coatings, or the blanket cylinder, for the application of continuous coatings, to said copy sheets.

4. A printing machine according to claim 1 in which said intermediate drying station also comprises a vapor extraction means.

5. A printing machine according to claim 1 in which said means comprises an air knife.

* * * * *

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United States Patent [19]

Switall

[11] **Patent Number: 4,617,865**

[45] **Date of Patent: Oct. 21, 1986**

[54] **LIQUID COATER FOR A PRINTING PRESS WITH MOVEABLE INKING ROLLER AND TRAY**

[75] Inventor: **Thomas G. Switall**, Wheeling, Ill.

[73] Assignee: **Ryco Graphic Manufacturing, Inc.**, Wheeling, Ill.

[21] Appl. No.: **763,274**

[22] Filed: **Aug. 7, 1985**

[51] **Int. Cl.⁴** **B41F 31/00**

[52] **U.S. Cl.** **101/350**; 101/367

[58] **Field of Search** .... 101/348–352, 101/375, 364, 247, 367, 207–210, DIG. 10, 148, 137, 139–140, 143–145, 182–185

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Primary Examiner—E. H. Eickholt
Attorney, Agent, or Firm—Lee, Smith & Zickert

[57] **ABSTRACT**

The coating apparatus disclosed in this application is for a printing press having a recessed printing cylinder. The mechanism comprises a frame, a tray mounted on the frame for holding a supply of the coating material and roller means carried by the frame for transferring the liquid coating material from the tray to the printing cylinder. A pair of track members extend upwardly and rearwardly from the press and the frame is mounted on these tracks for movement toward and away from the printing press cylinder. Means is provided for moving the frame between its remote position and its position adjacent the printing press cylinder. The roller means and the tray are preferably mounted on a subframe which is pivotally mounted on the frame and means is provided for pivoting the subframe so that the roller means will move into position for engagement with the printing press cylinder after the frame has been moved into its position adjacent the cylinder. Means is also provided for positively locking the frame in its position adjacent the cylinder.

17 Claims, 9 Drawing Figures

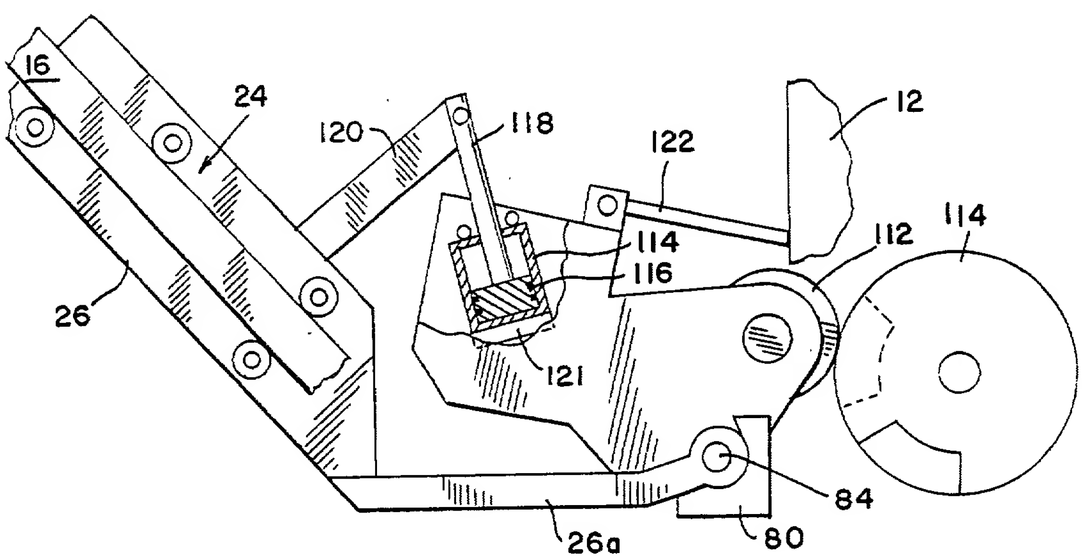

FIG-4

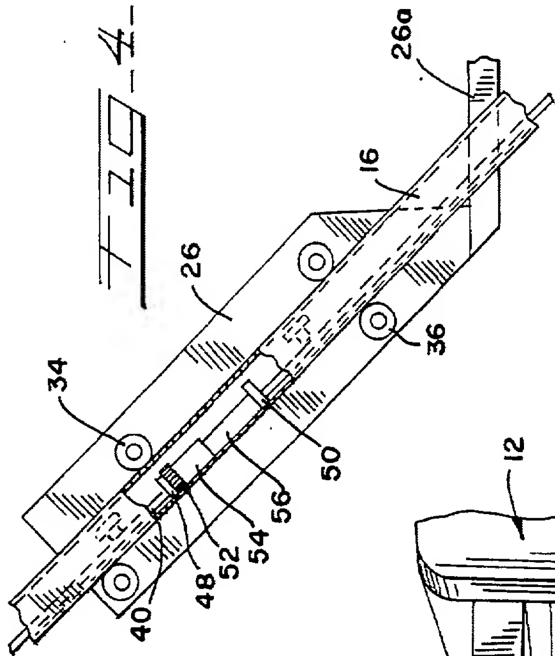
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FIG-1

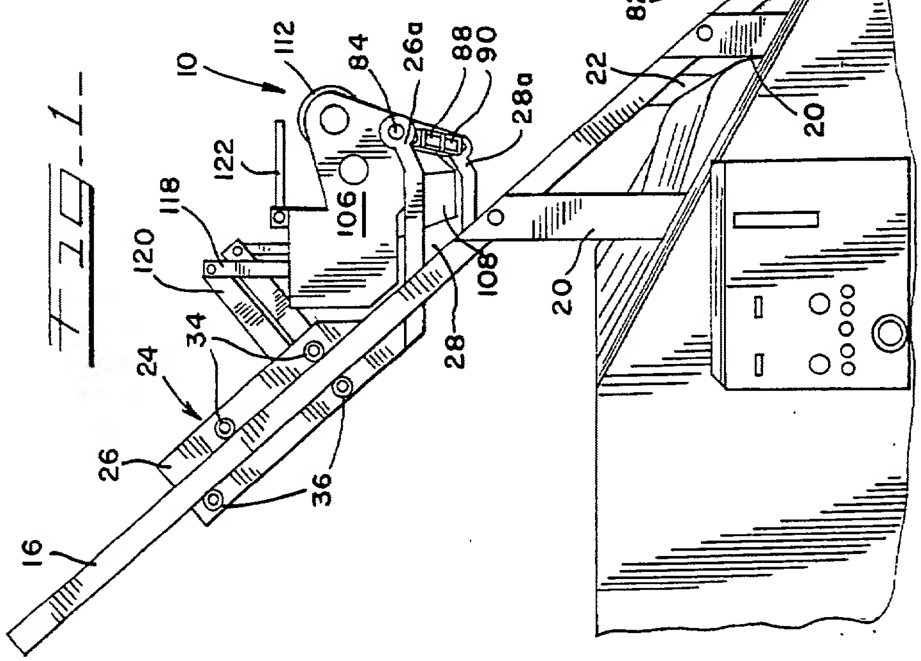
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Fig_2_

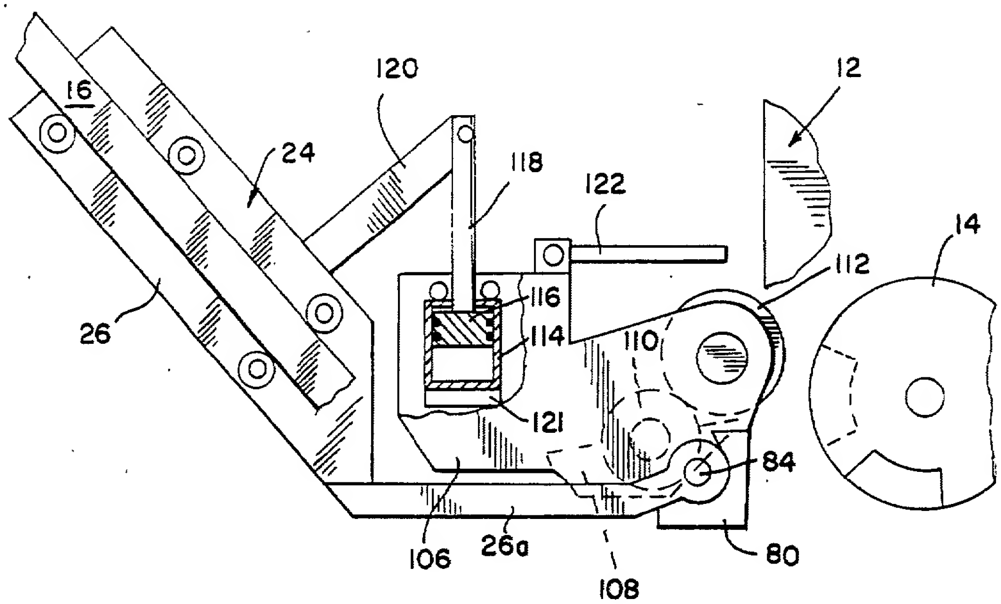

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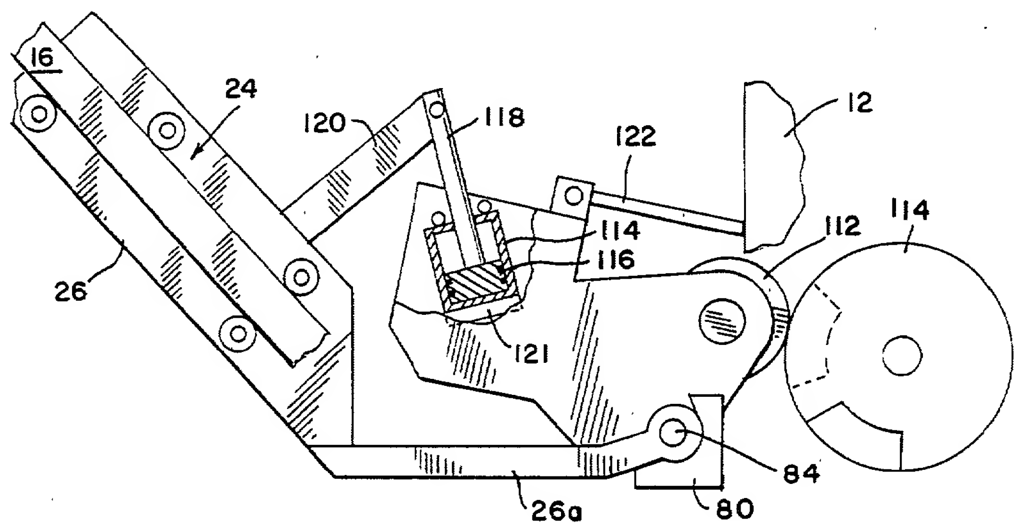
Fig_3_



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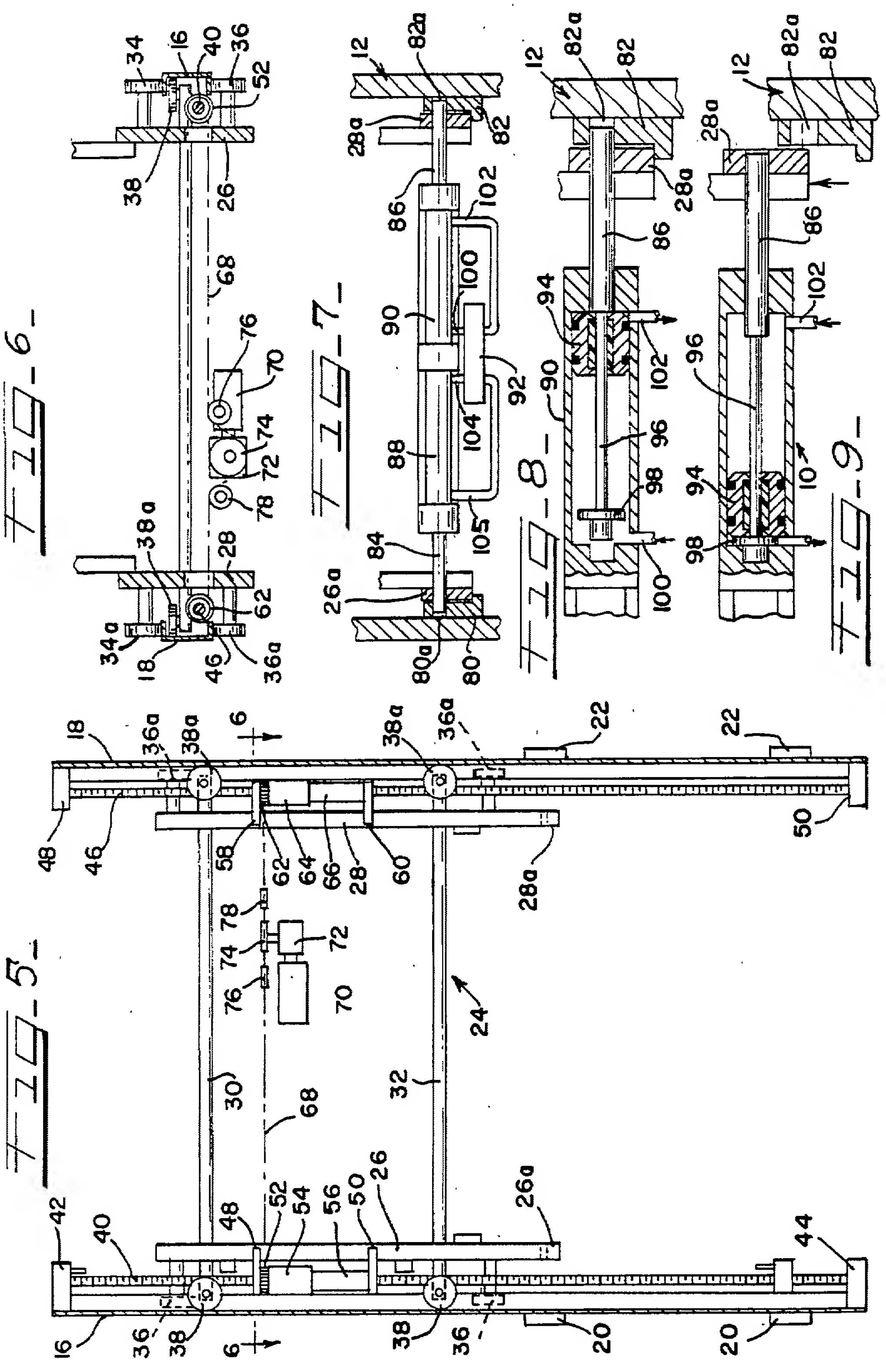

FIG. 5

FIG. 6

FIG. 7

FIG. 8

FIG. 9

LIQUID COATER FOR A PRINTING PRESS WITH MOVEABLE INKING ROLLER AND TRAY

BACKGROUND AND SUMMARY OF THE INVENTION

This invention relates to a liquid coater for supplying a liquid coating material to a printing press cylinder for transfer to the paper web or sheet being printed. The mechanism has particular application to a printing press having a recessed cylinder. The mechanism permits the coating rollers and tray holding the coating material to be selectively moved into and out of position for coating. When the coating rollers and tray are moved out of position they will not interfere with the printing operation or otherwise be in the way of the press operator.

It has become common practice to utilize a coater for applying a liquid coating material to the blanket of a web offset printing press so that the printed sheet or web which is moving through the press can be coated. The coating material is usually an aqueous coating which when dry renders the printed paper resistent to moisture and oils and prevents smearing. The coaters for applying this material generally utilize a tray for holding the liquid coating material and a feed roller rotating in the liquid coating material in the tray. A coater roller is in rotating engagement with the feed roller and also in rotating engagement with the blanket cylinder of the printing press. The coating material is picked up from the tray by the feed roller, transferred to the coater roller, and retransferred to the blanket by the coater roller.

Since the coater is an adjunct to the printing press, the main function of the press being to print, the coater must be capable of being moved into and out of position with respect to the blanket cylinder. The coater may be rotrofitted onto existing presses, or it may be worked into existing press designs. In most presses, the coater can be easily added and is not in the way of the printing operation of the press. However, in a number of printing presses, the blanket cylinder is recessed so that there is very little room for the coater to be moved into position for coating the blanket cylinder. Heretofore, it has not been possible to utilize a coater with such presses because the coater would be in the way of the press operator and interfere with the normal printing operation of the press. Thus, with presses such as the "Heidelberg Speed Master", a separate coater was heretofore required.

The present invention obviates the need for a separate coater and permits the coater to be mounted on presses which have a recessed blanket cylinder. In accordance with this invention, the coater may be moved into and out of position so that it does not interfere with the printing operation of the press and it permits the printed material to be coated as it is being moved through the printing press, thus, not only saving equipment, but saving time and labor by eliminating a separate operation on a separate piece of equipment.

In accordance with one aspect of the invention, the coater mechanism for applying a liquid coating material to the recessed printing press cylinder comprises a frame, a tray mounted on the frame for holding a supply of the coating material and roller means carried by the frame for transferring the coating material from the tray to the printing press cylinder. Track means is attached to the printing press and extends from adjacent the printing press cylinder to a point remote from the printing press cylinder. The tray and roller means are preferably mounted on a subframe attached and carried by the coater frame and the coater frame in turn in mounted on the track means. Means is provided for moving the frame and the subframe with the tray and roller means carried thereon, along the track means into and out of position adjacent the printing press cylinder, and means is provided for moving the roller means into and out of position for engagement with the printing press cylinder after the coater frame has been moved to its position adjacent the cylinder. It is preferred that there be a means for locking the coater frame in its position adjacent the cylinder when it has been moved into that position. Once the frame has been moved into its position adjacent the printing press cylinder, and the subframe has been moved to position the roller means into contact engagement with the printing press cylinder, the liquid coating material may be picked up from the tray by the roller means and applied to the printing press cylinder.

In the preferred embodiment, the track means comprises a pair of rectilinear tracks which extend upwardly and rearwardly and roller means on the frame rollably engage the track means so that the frame may be moved relative to the track means toward and away from the printing press cylinder.

The frame may be moved along the track means by means of a pair of internally threaded nut members mounted for rotation adjacent opposite sides of the coater frame. Extending through the nut members and mounted in fixed position relative to the track means are a pair of spaced parallel, externally threaded rods. The drive means includes means interconnecting the nut members and for rotating them in unison selectively in a direction which will move the frame toward the press cylinder and in the opposite direction away from the press cylinder.

The subframe is preferrably pivotally mounted on the front arms of the frame so that when the frame has been moved to its lower-most position adjacent the press cylinder, the subframe may be pivoted or tilted forwardly to bring the roller means into contact with the printing press cylinder so that the coating material may be applied to the printing press cylinder.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a coater constructed in accordance with this invention showing the coater moved out of its coating position, i.e. away from engagement with the blanket cylinder of the web offset printing press.

FIG. 2 is an enlarged side elevation view of portions of the press and coater schematically showing the coater after it has been moved to its coating position adjacent the printing press cylinder.

FIG. 3 is an enlarged side elevation view of the same portions of the press and coater showing the pivotal or tilting movement of the subframe to cause the coater roller to engage the surface of the printing press cylinder for the transfer of liquid coating material thereto.

FIG. 4 is a side elevation view of a portions of the coater frame and track means, with part of the track means cut away to show part of the drive means for moving the frame of the coater along the track means toward and away from the printing press cylinder.

FIG. 5 is a top plan view of portions of the frame and track means with the subframe removed, showing the

drive means for moving the frame along the track means.

FIG. 6 is a sectional end elevational view taken substantially the lines 6—6 of FIG. 5.

FIG. 7 is a sectional view taken across the front arms of the frame and showing the means for locking the frame into its lower-most position adjacent the press cylinder.

FIG. 8 is an enlarged end elevational view of a portion of the locking mechanism showing the mechanism in its locking position.

FIG. 9 is a view similar to FIG. 8 showing the locking mechanism after it has been moved to its unlocked position and after the frame has been moved away from its position adjacent the press cylinder.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The coater **10** constructed in accordance with this invention is illustrated in FIG. **1** where it is used on a web offset press **12**. The press has a blanket cylinder **14** which is normally used in the offset printing operation of the press. However, printing presses of this type have a number of different printing stages, usually one for each color, and where one of the stages or printing roller sets is not being used for printing, it has been found convenient to utilize the blanket cylinder of that otherwise unused stage of the printing press as a means for applying a coating to the web or sheet as it moving through the press. The coating material is usually an aquaeous coating which provides moisture and oil resistant matte or glossy finish to the paper and protects it from smearing.

The particular press **12** illustrated in FIG. **1** has very little room within which to apply the coating material and heretofore it has been impossible to use a coater in such a press where the blanket cylinder was recessed and other portions of the printing press prevented the coater from being moved rearwardly away from its coating position so that the blanket cylinder could be used for a printing operation as well as a coating operation.

In order to move the coater **10** into and out of position for applying the coating material to the blanket cylinder **14**, a track means in the form of two channel-shaped tracks **16** and **18** are connected to the frame of the press **12** by means of supports **20** and **22**, respectively (see FIG. **5**). The tracks **16** and **18** extend upwardly and rearwardly at an angle of approximately 45 to 50 degrees from the horizontal. Mounted between the tracks **16** and **18** is a carriage frame **24** consisting of a pair of parallel side plates **26** and **28** and a pair of transverse bars **30** and **32** which extend between the side plates thus forming a substantially rectangular frame. The side plates **26** and **28** have arms **26*a*** and **28*a*** which extend forwardly and outwardly at approximately a supplementary angle with the angle of the tracks **16** and **18** so that these arms will be generally horizontal in their orientation at all times and in all positions of movement of the carriage frame **24** relative to the tracks.

The carriage frame **24** is mounted on the tracks for movement between a remote position as illustrated in FIG. 1 and a position where the coater is adjacent the blanket cylinder **14** of the printing press, schematically illustrated in FIGS. **2** and **3**. For this purpose, on each of the side plates **26** and **28** there are two pairs of rollers. Roller pair **34** adjacent the top of the side plate **26** roll along the top flange of the channel-shaped track **16** and roller pair **36** located adjacent the bottom of the side plate **26** roll along the bottom flange of the track **16**. This is illustrated in FIG. **1**. Similar pairs of rollers **34*a*** and **36*a*** extend outwardly from the side plate **28** to rollably engage the top and bottom flanges, respectively, of the channel-shaped track **18**. This is shown in FIGS. **5** and **6**. As may also be seen in those figures, rollers **38** and **38*a***, rotating on vertical axes, engage the inside vertical surfaces of the tracks **16** and **18**, respectively. Thus, the coater carriage frame **24** is able to move up and down the angular tracks **16** and **18** on the rollers **34, 36** and **38** and **34*a*, 36*a*** and **38*a***, respectively.

Means is also provided for forcibly moving the carriage frame along the tracks and this is through a synchronized screw-thread drive. An externally threaded rod **40** is mounted between end mounts **42** and **44** at each end of the track **16**. This rod which is a ball screw is mounted in fixed position and extends parallel to the track **16**. Similarly, a ball screw **46** extends between end mounts **48** and **50** at the ends of the track **18** and this ball screw is also mounted in fixed position and extends parallel to the track **18**. Extending outwardly from side plate **26** of the carriage frame are a pair of support brackets **48** and **50**, and journalled for rotation between these brackets is a sprocket **52**, a connector **54** and a ball nut **56**. The sprocket, connector and ball nut surround the ball screw **40**, and the internally threaded ball nut **56** is in threaded engagement with the threads of the ball screw **40**. Similarly, on the opposite side of the carraige frame, a pair of spaced brackets **58** and **60** extend outwardly from side plate **28**. Journalled for rotation between these brackets is a sprocket **62**, a connector **64** and a ball nut **66**, all of which surround the ball screw **46**. The connectors **54** and **64** connect the sprockets **52** and **62** to their respective ball nuts **56** and **66**. The sprockets **52** and **62** are operatively connected together and driven in unison by means of a sprocket chain **68**. The sprocket chain in turn is driven by means of a motor **70** operating through a reduction gear box **72** and a drive sprocket **74**. On either side of the drive sprocket **74** are idler sprockets **76** and **78**.

Thus, the carriage frame **24** may be rolled along the tracks **16** and **18** through operation of the motor **70** which may be driven in the forward or reverse directions to drive the sprocket chain **68** and the sprockets **52** and **62**. These sprockets, which are connected to the ball nuts **56** and **66**, respectively, will rotate these ball nuts relative to the ball screws **40** and **46**, respectively, causing the ball nut **56** to move up or down on the ball screw **40** and the ball nut **66** to move or down on the ball screw **46**, thereby driving the carriage frame **24** upwardly or downwardly, depending upon the direction of operation of the motor **70**.

While the ball nuts **56** and **66** may be any kind of internally threaded member to mate with the externally threaded rods **40** and **46** respectively, it is preferred that these be ball nuts and rods. The ball nuts have ball bearings arranged in an internally threaded fashion and the external threads of the ball screw **40** are adapted to mate with the ball bearings thus providing a very low friction type of connection between threse two internally and externally threaded members.

The frame **24** is adapted to be moved between an elevated and rearwardly disposed position substantially as illustrated in FIG. **1** to a lowered and forwardly disposed coating position as shown schematically in FIG. **2**. In this lowered position, the rounded forward end of the arm **26*a*** will seat in a positioning block **80**

mounted on one side of the press frame, and the corresponding arm 28a of side plate 28 will seat within a correspondingly positioning block 82 mounted on the opposite side of the press frame (see FIGS. 1, 2 and 7).

Means is provided for locking the carriage frame in its lowered position adjacent the blanket cylinder of the press. This mechanism is illustrated in FIGS. 7-9. The positioning blocks 80 and 82 mounted on opposite sides of the frame of the press 12 have holes 80a and 82a, respectively, which serve as keepers for the locking pins 84 and 86. As shown in FIG. 7, when the side plate arms 26a and 28a of the carriage frame have been moved into position in seating engagement with the positioning blocks 80 and 82 respectively, the locking pins 84 and 86 will align with the respective holes 80a and 82a on the positioning blocks. In FIG. 7, the locking pins are in position within the keeper holes 80a and 82b, thus locking the carriage frame arms 26a and 28a in their lowermost position.

In order to effect locking and unlocking movements of the locking pins 84 and 86, a pair of air cylinders 88 and 90 are provided and these are controlled by means of an air valve 92. As may be seen in FIGS. 8 and 9, each of the air cylinders 88 and 90 has a moveable piston 94 which has a lost motion connection with the shank 96 of the locking pin, and at the end of the shank there is an enlarged head portion 98. The shank 96 is of substantially smaller diameter than the diameters of either the head portion 98 or the locking pins 84 and 86, and there are air ports 100 and 102 for cylinder 90 and corresponding air ports 104 and 106 for the air cylinder 88.

When the air valve 92 permits air under pressure to enter air port 100 and to exit air port 102 of the cylinder 90, the piston 94 within that cylinder will be driven to the right as illustrated in FIG. 8 and impact against the locking pin 86 to drive the pin to the right into the keeper hole 82a of the positioning block 82. When it is desired to unlock the arms of the carriage frame, the air valve 92 is reversed, causing air to enter air port 102 and exit air port 100. This will drive the piston 94 to the left as illustrated in FIGS. 8 and 9 to the position illustrated in FIG. 9 where it impacts the large head 98 and drives that head together with the shank 96 and the locking pin 86 to the left, thereby withdrawing the pin 86 from the keeper hole 82a.

The operation of the air cylinder 88 is identical and simultaneous when the air valve 92 permits air to enter air port 100 it also permits air to enter air port 104 of cylinder 88 so that both pistons of the air cylinders are driven outwardly to drive the pins 84 and 86 into their respective keepers 80a and 82a to lock the arms of the carriage frame in position. When the air valve 92 is reversed and air is permitted to enter air port 102 of the cylinder 90, it also enters air port 105 of the cylinder 88 to drive the respective pistons 94 inwardly toward one another extracting the locking pins 84 and 86 from their respective keepers thereby unlocking the arms 26a and 28a of the carriage frame.

Pivotally mounted on the locking pins 84 and 86 is a subframe 106 on which is carried a tray 108, a feed roller 110 and the coater roller 112. The liquid coating material is contained in the tray 108 and is picked up by the feed roller 110 and applied to the coater roller 112 in the usual and well known manner. The coater roller is then adapted to contact the blanket cylinder 14 to apply the coating material to the blanket cylinder.

It is important to note that the locking pins 84 and 86 form the pivotal axis of the subframe 106 and when these pins enter their respective keeper holes 80a and 82a, the pivotal axis of the subframe and of the coater roller 112 will be accurately determined and will be firmly anchored in place relative to the press 12, preventing movement of this pivotal axis during the coating operation.

When the coater frame has been moved to its lowermost position adjacent the blanket cylinder 14, and the arms 26a and 28a have been locked in their position. As previously described, the coater roller 112 will be positioned in spaced relationship with the blanket cylinder 14. In order to bring the coater roller into contact with the blanket cylinder 14, the subframe 106 is pivoted about the now firmly anchored locking pins 84 and 86 from the position illustrated in FIG. 2 to the position illustrated in FIG. 3. This pivoting or tilting movement of the subframe may be accomplished by means of an air cylinder 114 pivotally mounted on the subframe and having a moveable piston 116. An operating rod 118 is pivotally connected to a rigid upstanding arm 120 mounted on the carriage 24. The air cylinder is operated by an air valve 121 similar to valve 92, previously described in connection with the locking mechanism. When the piston 116 is moved to is elevated position illustrated in FIG. 2, the subframe is in its normal horizontal position with the coater roller 112 out of contact with the blanket cylinder 14. When the piston 116 is moved to its lower position by the controlling air valve 121, the subframe 106 will be pulled upwardly and tilted about the axis of the locking pins 84 and 86 to the position illustrated in FIG. 3 placing the coater roller in contact with the surface of the blanket cylinder 14. So that this position may be accurately determined, it is preferred that there be a rigid arm 122 which extends forwardly to engage the frame of the press 12 when the subframe 106 has been tilted to its position as illustrated in FIG. 3. In the illustrated embodiment, the air piston 114 is pivotally mounted on the subframe 106 so that when the subframe is tilted or pivoted about is axis, the air cylinder 114 may also be tilted about its axis.

The foregoing preferred embodiment has been described only by way of example and it will be appreciated that there are many modifications which can be made without departing from the spirit and scope of the invention as hereinafter claimed. For example, various other track arrangements can be employed for moving the carriage 24 up and down, and the means for forcibly moving the carriage along the tracks may also be varied. If desired, the rods 40 and 46 could be rendered moveable with the ball nuts 56 and 66 stationary. In this manner, the motor for rotating the rod 40 and 46 could be located on the track. However, this is not preferred. Various other and well known locking mechanisms could be used to lock the frame in its lowered position adjacent the blanket cylinder and various means other than that disclosed can be used to tilt the subframe into contact with the blanket cylinder.

The coater described herein solves the problem of how to provide a coater for the blanket cylinder where that blanket cylinder is recessed and where the rearward movement of the coater away from the blanket cylinder would be normally prohibited.

What is claimed is:

1. In a printing press having a recessed printing press cylinder, a coater for applying a liquid coating material to the printing press cylinder, said coater comprising a

frame, a tray mounted on said frame for holding a supply of coating material, roller means carried by said frame for transferring coating material from said tray to the printing press cylinder, track means attached to the printing press and extending from adjacent said printing press cylinder to a point remote from said printing press cylinder, frame moving means for moving said frame and said tray and roller means carried thereby along a first path defined by said track means into and out of position adjacent said printing press cylinder, and tray and roller moving means for moving said roller means along a second path which differs from and intersects said first path into and out of position for engagement with the printing press cylinder after said frame has been moved to its position adjacent said cylinder. whereby liquid coating material may be picked up from said tray and applied to said printing press cylinder by said roller means.

2. The structure of claim 1 wherein said track means comprising a pair of spaced parallel rectilinear tracks.

3. The structure of claim 2 wherein said tracks extend upwardly and rearwardly from adjacent said printing press cylinder.

4. The structure of claim 2 and further including frame locking means for locking said frame in position adjacent said printing press cylinder while permitting said tray and roller moving means to move said roller means transversely into and out of position for engagement with said printing press cylinder.

5. The structure of claim 1 wherein track-engaging roller means is provided on said frame for engaging said track means whereby said frame may be rollaby moved along said track means.

6. The structure of claim 1 wherein said frame moving means comprises

first threaded means on said frame,

second threaded means on said track means in threaded engagement with said first threaded means,

drive means for rotating one of said threaded means relative to the other, whereby said frame may be selectively moved along said track means toward and away from adjacent said printing press cylinder.

7. The structure of claim 6 wherein said first threaded means comprises at least one internally threaded nut member, and said second threaded means comprises at least one externally threaded rod member.

8. The structure of claim 7 wherein said nut member is journalled for rotation on said frame, said rod member is mounted in fixed position relative to said track means, and said drive means is operatively connected to said nut member to selectively rotate said nut member relative to said rod member.

9. The structure of claim 8 wherein said nut member is a ball nut.

10. The structure of claim 1 wherein said tray and roller moving means comprises, a subframe pivotally mounted on said frame and carrying said tray and roller means, and subframe moving means for pivotally moving said subframe between a first position wherein said roller means is out of engagement with said printing press cylinder and a second position wherein said roller means is in position for engagement with said cylinder.

11. The structure of claim 10 and further including stop means mounted on said subframe in position for engaging the printing press and stopping the pivotal movement of said subframe when said roller means has reached its position for engagement with said cylinder, whereby the coating position of said roller means may be accurately determined.

12. The structure of claim 10 wherein said subframe moving means comprises an air cylinder mounted on said frame having a moving piston operatively connected to said subframe.

13. The structure of claim 4 wherein said frame locking means comprises latch means carried on said frame, keeper means carried by said printing press and means for forcibly moving said latch means into said keeper means when said frame has been moved into a position adjacent said cylinder.

14. The structure of claim 13 wherein said means for forcibly moving said latch means includes at least one piston having a lost motion connection with said latch means, whereby said latch means may be driven by impact into and out of engagement with said keeper means.

15. The structure of claim 14 wherein said latch means includes a pair of latch pins on opposite sides of said frame, and said fluid actuated piston means comprises a pair of pistons, each having a lost motion connection with a respective one of said latch pins, and means for moving said pistons selectively in opposite directions, whereby said latch pins may be simultaneously driven by impact into and out of engagement with said keeper means.

16. In a printing press having a recessed printing press cylinder, a coater for applying a liquid coating material to the printing press cylnder, said coater comprising a frame, a subframe pivotally mounted on said frame and carrying a tray for holding a supply of coating material and roller means for transferring the coating material from said tray to the printing press cylinder, a pair of spaced tracks attached to the printing press and extending from adjacent said printing press cylinder to a point remote from said printing press cylinder, first drive means for moving said frame along said tracks toward and away from a position adjacent said printing press cylinder, means at the pivotal axis of said subframe for locking said frame in its position adjacent said printing press cylinder, whereby the pivotal axis of said subframe will be accurately fixed relative to the press, and second drive means for pivotally moving said roller means into and out of position for engagement with the printing press cylinder after said frame has been moved to and locked in its position adjacent said cylinder, whereby liquid coating material may be picked up from said tray and applied to said printing press cylinder.

17. In a printing press having a recessed printing press cylinder, a coater for applying a liquid coating material to the printing press cylinder, said coater comprising a frame, a tray mounted on said frame for holding a supply of coating material, roller means carried by said frame for transferring coating material from said tray to the printing press cylinder, track means attached to the printing press and extending from adjacent said printing press cylinder to a point remote from said printing press cylinder, frame moving means for moving said frame and said tray and roller means carried thereby along said track means into and out of position adjacent said printing press cylinder, and tray and roller moving means for moving said roller means into and out of position for engagement with the printing press cylinder after said frame has been moved to its position adjacent said cylinder, whereby liquid coating material may be picked up from said tray and applied to said printing

press cylinder by said roller means, said frame moving means comprising a pair of internally threaded nut members journalled for rotation on opposite sides of said frame, a pair of spaced parallel externally threaded rods mounted in fixed position relative to said track in threaded engagement with said nut members, and drive means operatively interconnecting said nut members for rotating said nut members in unison relative to said rods selectively in one direction to move said frame along said track means toward said printing press and in the opposite direction to move said frame away from said printing press.

* * * * *

7

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 4,825,804

DATED : May 2, 1989

INVENTOR(S) : Mark A. DiRico et al.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Change the inventor's name from "Mark A. Dirico" to --Mark A. DiRico--.

U.S. Patent Documents, 4,685,414, "Direco" should be --DiRico--.

Column 1, line 32, "(i)a" should be --(i) a--.

Column 2, line 15, "DRAWINGS" should be on separate line as a subheading.

Column 2, line 58, delete "by" (first occurrence).

Column 5, line 35, "shaft" should be --shafts--.

Signed and Sealed this

Twenty-fourth Day of April, 1990

Attest:

HARRY F. MANBECK, JR.

Attesting Officer

Commissioner of Patents and Trademarks

United States Patent [19]

Dirico et al.

[11] **Patent Number:** 4,825,804

[45] **Date of Patent:** May 2, 1989

[54] **VERTICALLY RETRACTING COATER**

[75] Inventors: **Mark A. Dirico**, Quincy, Mass.; **Phillip Rodriguez**, Garland, Tex.

[73] Assignee: **Dahlgren International, Inc.**, Dallas, Tex.

[21] Appl. No.: **42,374**

[22] Filed: **Apr. 24, 1987**

[51] **Int. Cl.**[4] **B05C 11/00**

[52] **U.S. Cl.** **118/46**; 118/262

[58] **Field of Search** 118/46, 262

[56] **References Cited**

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Primary Examiner—Shrive Beck
Assistant Examiner—Alain Bashore

[57] **ABSTRACT**

A retractable coater is used on-line with the last unit of a standard offset lithographic printing press. The coater includes a coating assembly mounted on a platform and a retraction guide assembly, the latter comprising:

(i) a horizontal member and means for slidably supporting platform movement along the horizontal member;
(ii) a vertical member slidably guiding vertical movement of the platform and
(iii) means for slidably lifting the platform and coating metering assembly on a course guided by the vertical member.

14 Claims, 4 Drawing Sheets

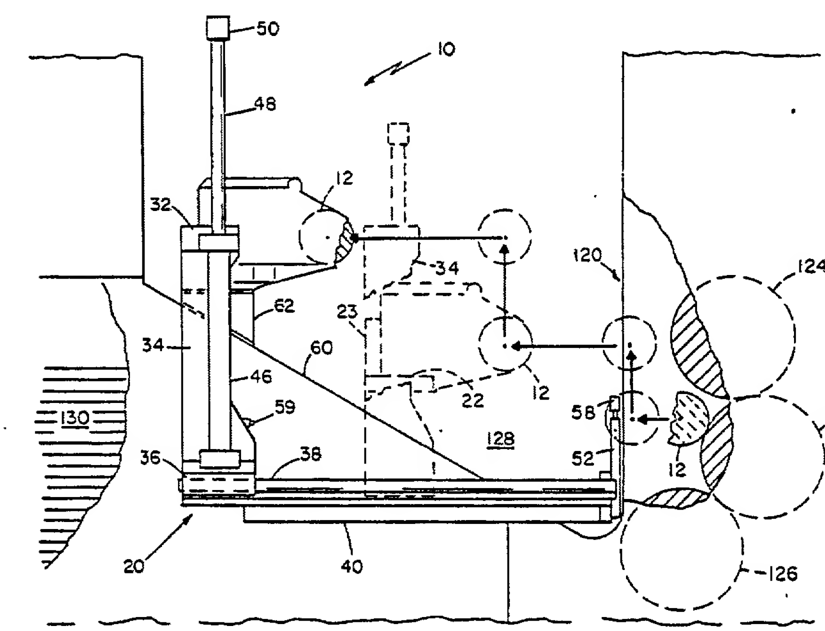
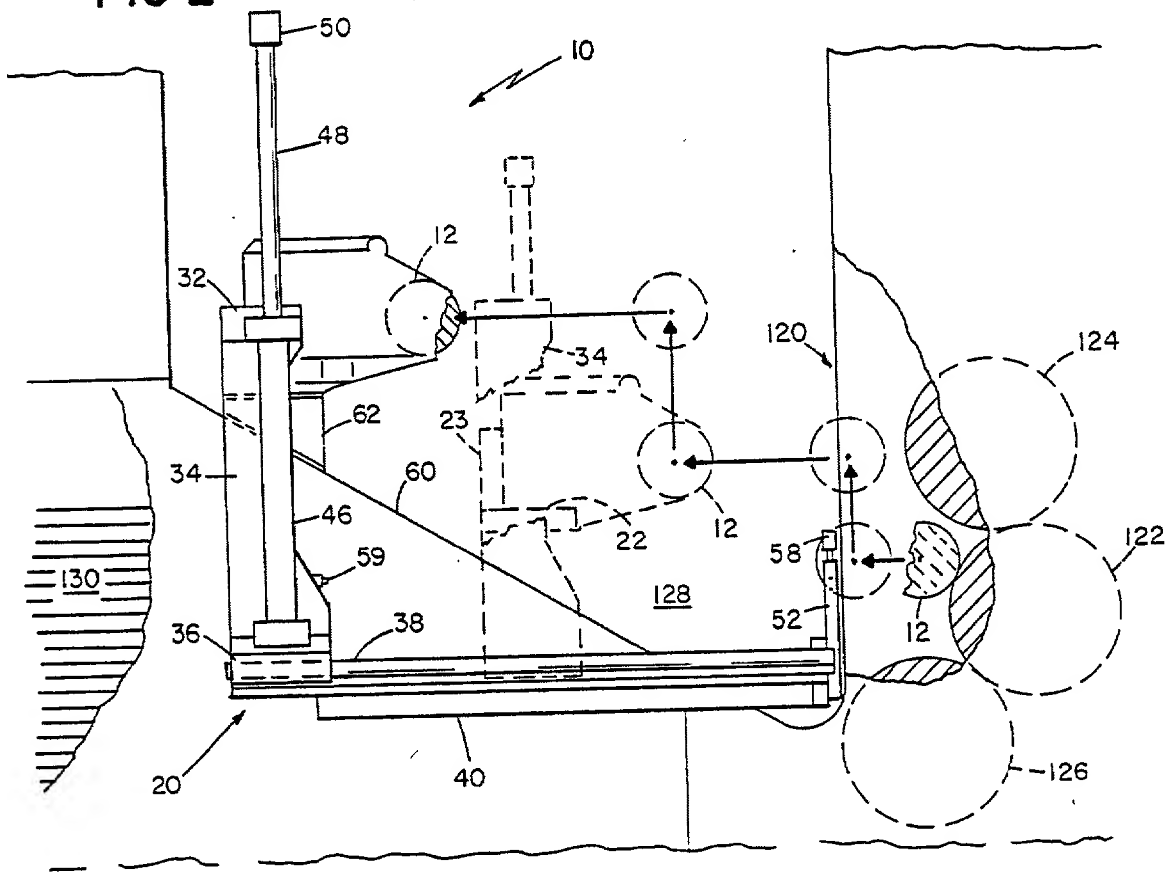


FIG 2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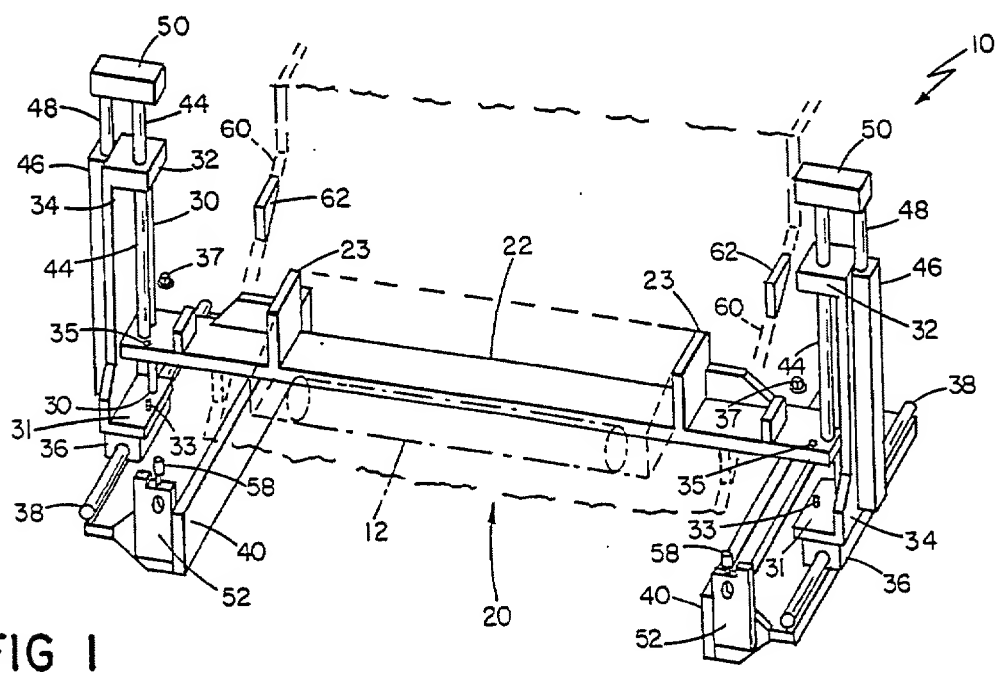
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FIG 1

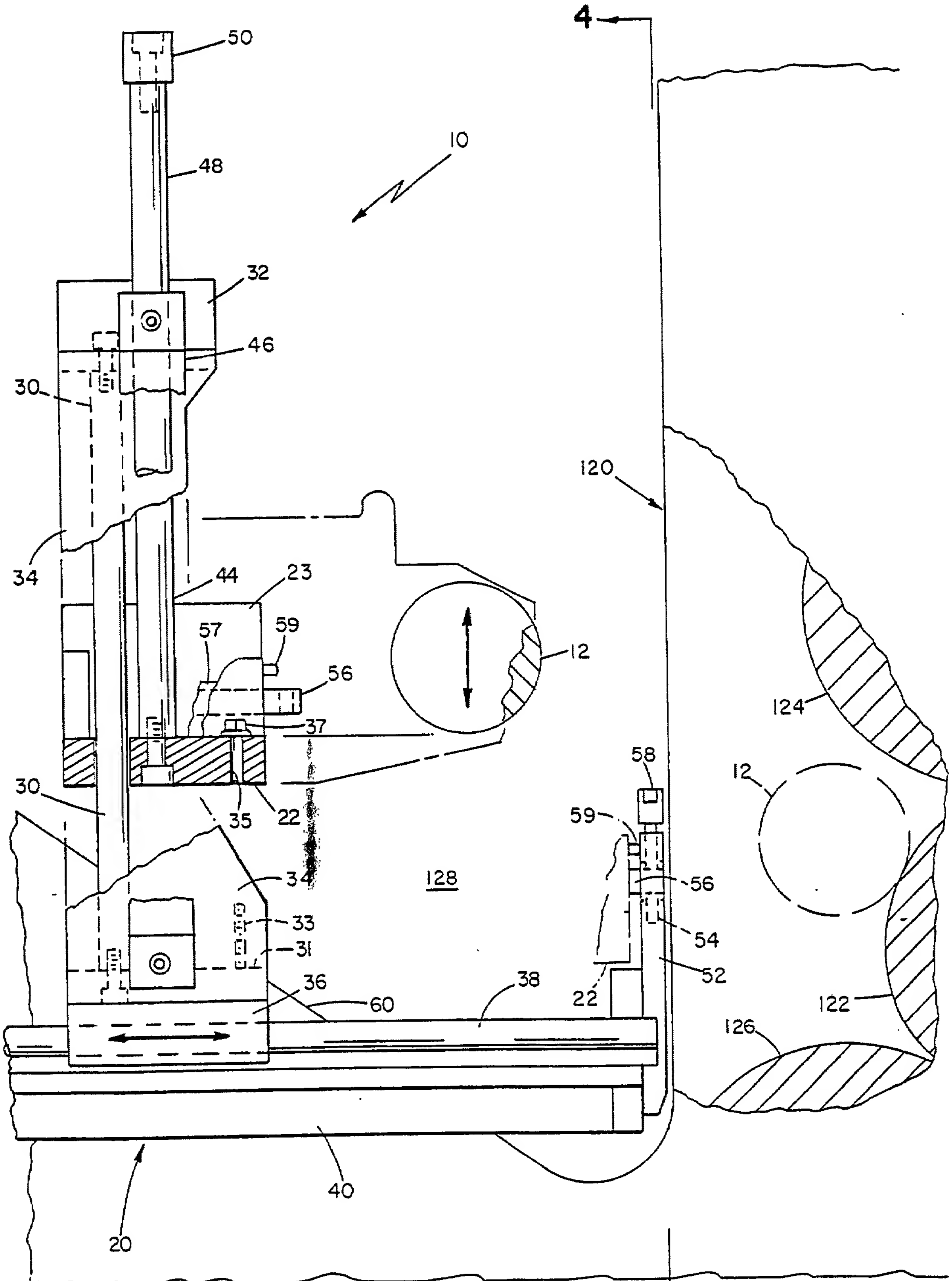
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FIG 3

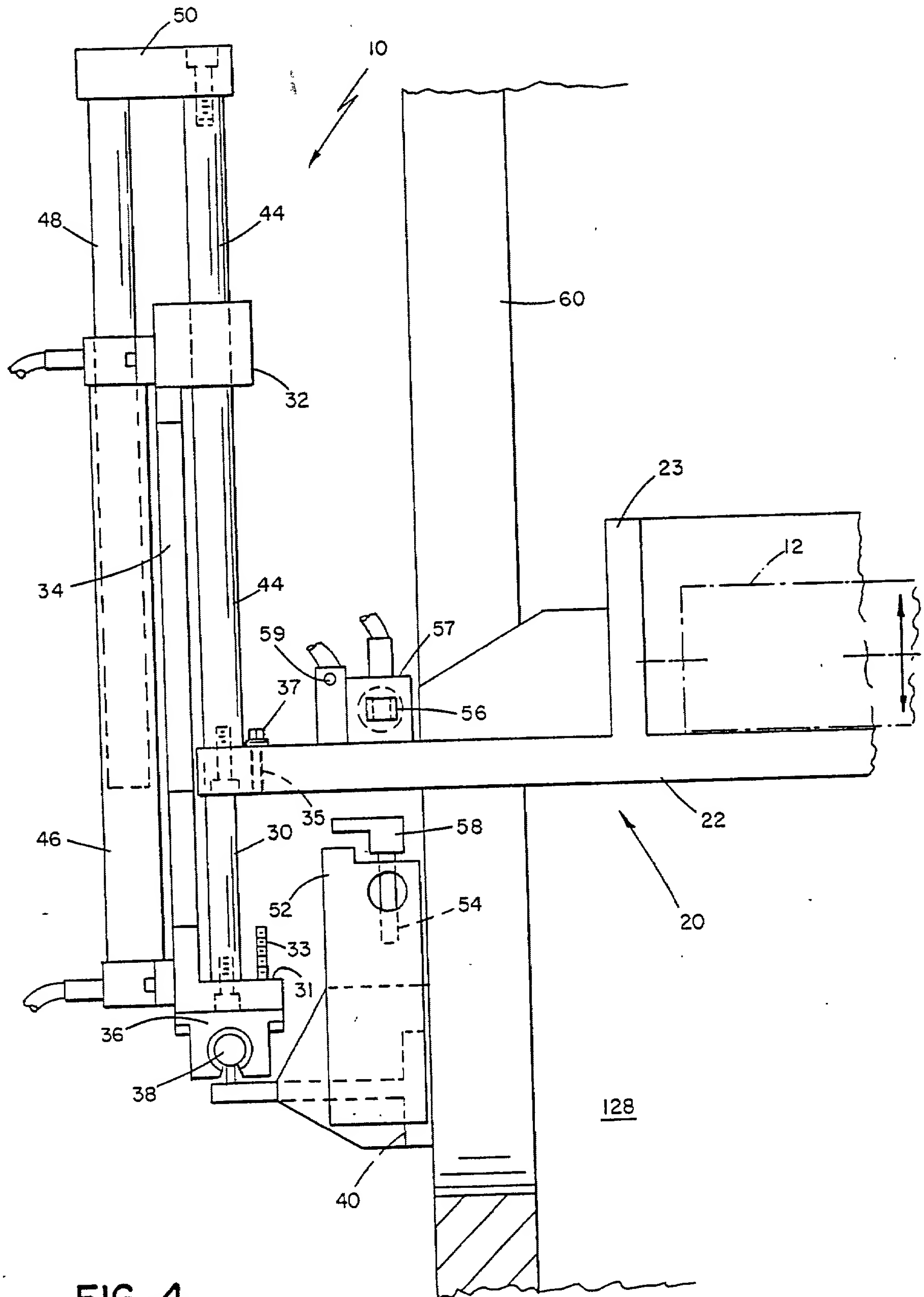
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FIG 4

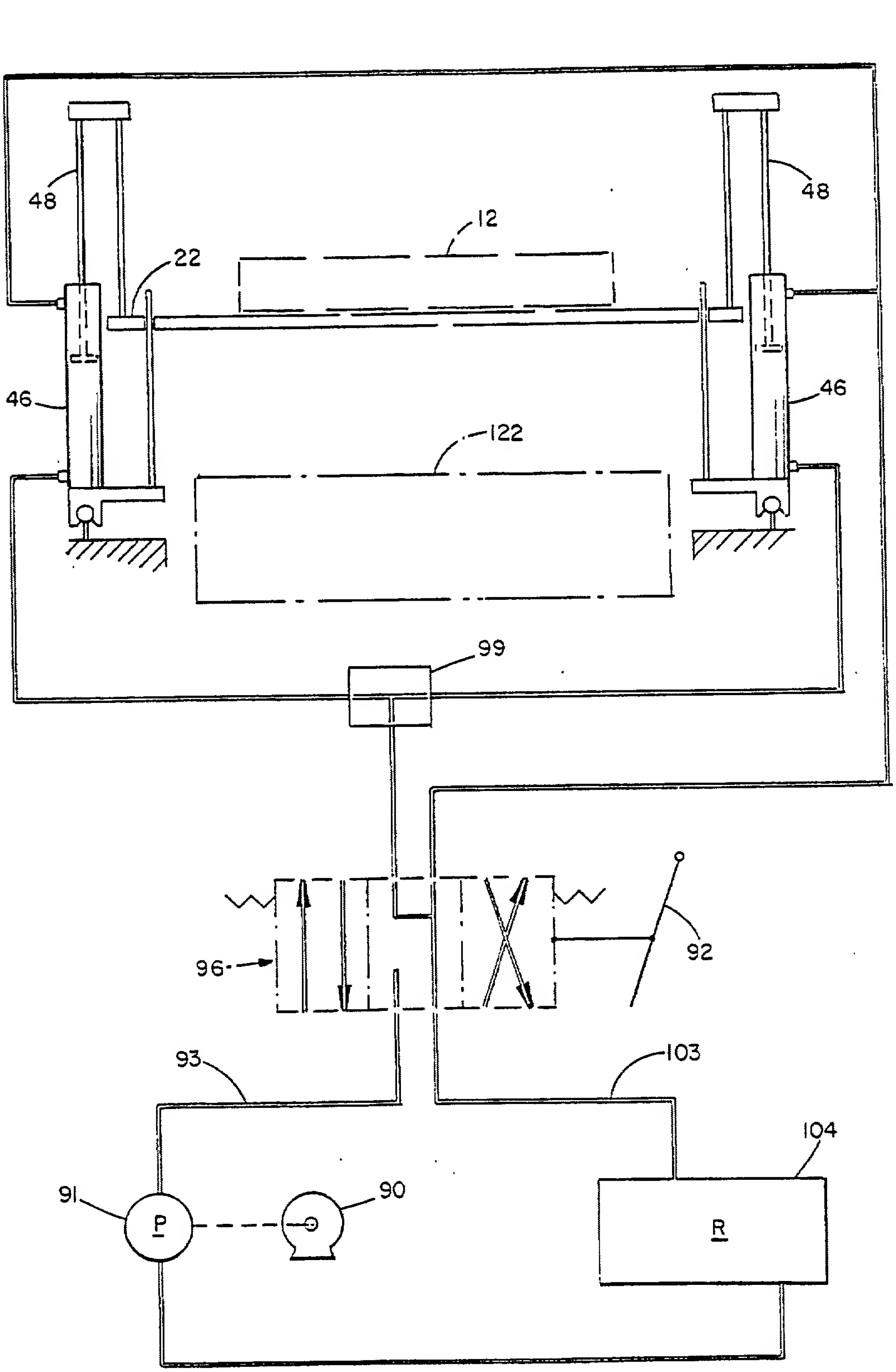

FIG 5

VERTICALLY RETRACTING COATER

BACKGROUND OF THE INVENTION

This invention relates to apparatus for coating a moving web, which is used on-line with a standard off set lithographic printing press unit.

As described in commonly owned, allowed U.S. patent application Ser. No. 719,474, now U.S. Pat. No. 4,685,414, which is hereby incorporated by reference, the final unit of a multi-unit lithographic press can be used to apply coatings. Specifically, a textured roller and coating feed mechanism are fixed to a movable platform, which is locked in place to meter coating to the blanket cylinder of the final press unit. The blanket transfers coating to the workpiece.

As further disclosed in Ser. No. 719,474, when the final unit is needed to print an additional color, the platform, together with the textured roller and the coating feed (including a doctor blade assembly), can be disengaged and moved horizontally away from the final press unit. The dampener and inking mechanisms of the final press unit are then used for off set lithographic printing in the conventional manner.

SUMMARY OF THE INVENTION

The invention generally features a retractable coater for use on-line with the last unit of an off set lithographic printing press. The coater includes a coating assembly mounted on a platform and a retraction guide assembly, the latter comprising:

(i)a horizontal member and means for slidably supporting platform movement along the horizontal member;

(ii) a vertical member slidably guiding vertical movement of the platform and

(iii) means for slidably lifting the platform and coating metering assembly on a course guided by the vertical member.

Preferred embodiments of the invention include the features described below. The horizontal member is a shaft, or like guide member, attached along the outside of the press unit and the platform is adapted to engage a support cooperatively and slidably engaging the shaft. A vertical shaft extends from the platform support (to which the vertical shaft is attached), through an opening in the platform, to a guide block positioned above, and attached to, the support, so that the platform slidably engages the vertical shaft to guide vertical movement of the platform. A lift arm is connected to the platform and to a drive means, e.g. to a force-receiving member that is driven by a force delivering means. Lift is achieved using a pair of hydraulic cylinders, positioned on opposite sides of the platform and connected to hydraulic pressure means through a pressure-compensated flow divider that is adapted to maintain equal flow to each cylinder. In that way, the platform is kept level.

The above-described apparatus improves the ability to use the final press unit for two functions: coating and printing. Specifically, the invention enables the press operator to reliably engage the coating assembly to, and disengage the assembly from, the blanket roll of the final unit, for use as a coater. The invention further enables the operator to disengage the coating assembly and move it away from the final press unit both horizontally and vertically, so that the unit may be used as a conventional lithographic press unit. The vertical lift feature is particularly advantageous because it gives the press operator substantial access to the area between the press delivery, i.e. that region of the press which receives the finished work-product and stacks it for further processing, and the last printing unit. The coating assembly is self-contained and can easily be moved into and out of the operable position with very simple manipulations, yet the assembly is reliably guided and locked for use in a demanding environment.

Other features and advantages of the invention will be apparent from the following description of a preferred embodiment thereof.

DESCRIPTION OF THE PREFERRED EMBODIMENT DRAWINGS

FIG. 1 is a perspective view of a detachable coater, without the adjacent standard lithographic press unit, with parts omitted and parts shown in broken line for clarity.

FIG. 2 is a side view of the detachable coater of FIG. 1, with an alternate position shown in broken lines, with parts broken away and in section.

FIG. 3 is a side view of the detachable coater of FIG. 1, showing the laching mechanism, with parts broken away and in section.

FIG. 4 is a front view of one side of the detachable coater, taken along 4—4 of FIG. 3.

FIG. 5 is a diagram of the hydraulic circuitry of the detachable coater of FIG. 1.

STRUCTURE

In FIGS. 1-4, the detachable coater assembly **10** generally includes the features described in greater detail in U.S. Ser. No. 719,474, referenced above, and there is no need to repeat that description here. The major components of coater assembly **10** are a textured applicator roller **12**, a metering doctor blade (not shown), and a coating supply (not shown). The doctor blade and coating supply form a single assembly. Those basic features function generally as described in the '474 application.

This invention generally features the carriage and retraction mechanism for the above-described coater. In FIG. 1, the carriage platform **20** features a base support frame **22** spanning horizontally across press unit. Side frames **23** and **24** extend vertically upward on opposite sides of support frame **22**, to support the mounts for the coater assembly. Accordingly, the entire coater assembly is rigidly supported by base frame **22**, and retraction movement of frame **22** retracts the coater assembly.

The retraction and lift features on one end of frame **22** are described, with the understanding that the features on the opposite side are identical. Frame **22** is rigidly attached at each end to a vertical lift shaft **44**. Shaft **44** extends through an upper bearing block assembly **32**. Bearing block assembly **32** is supported by by a vertical support bar **34**, connected to a pillow block bearing **36**. Pillow block bearing **36** slidably surrounds slide shaft **38** which is supported by bracket **40**, which in turn is bolted to the press frame wall **60**. It is important to note that bracket **40** extends along the outside of frame wall **60** to support slide shaft **38** in the direction of the press delivery area **130**.

Also extending upwardly from block bearing **36** is guide shaft **30**, which slidably extends through frame **22** to upper bearing block assembly **32**. Hydraulic cylinder

46 is attached to the side of support bar 34 and controls a lift rod 48 which extends to force plate 50 upward, and thereby to lift shaft 44 and frame 22.

As best shown in FIGS. 2-4, press unit 120 includes a blanket cylinder 122, a plate cylinder 124, and an impression cylinder 126. The workpiece is transfered by additional cylinders (not shown) under well 128 to a workpiece delivery area 130, where the work can be delivered and periodically transferred elsewhere.

Each of the two plates 52 on the front of well 128 of press unit 120 has a vertical slot sized and shaped to receive a lock pin 54 (FIG. 3). A horizontal opening to the slot receives the cylinder shaft 56 (FIG. 4) of hydraulic cylinder 57. Pin 54 cooperatively engages a slot in shaft 56 when handle 58 is engaged, to a locking position. Removal of handle 58 and pin 54 releases shaft 56. The locking mechanism allows the coating assembly to be locked into place, with a repeatable, desired resilient tension. An adjustable stop 59 is positioned adjacent cylinder 57. Plate 52 may be mounted to 40 as shown or directly to wall 60 as disclosed in patent '474.

The wall 60 of press unit 120 slants diagonally downward from its highest point at press delivery 130. A support bracket 62 is bolted to wall 60 in position to support the ends of frame 22 when the coating assembly is fully raised and retracted.

FIG. 5 shows the hydraulic power system for the retractor. Electric motor 90 drives pump 91 to drive hydraulic fluid through supply line 93. Supply line 93 supplies directional valve 96, which, under the control of lever 92, determines which half of the hydraulic cylinders 46 receive flow from line 93. Downstream from directional valve 96, flow proceeds through a pilot check valve and a flow-control valve (not shown). Pressure-compensated flow divider 99 ensures that the flow is equal to each of the hydraulic retraction cylinders 46, so that the coater is automatically leveled. The return hydraulic flow is through a flow control valve and pilot check valve (not shown), directional valve 96, return line 103, reservoir 104 and, from there, to pump 91.

Operation

Initially, the coater assembly is in its retracted position, supported by brackets 62. In this position, the assembly is substantially out of the pressman's way, and the press unit is fully useful as an offset lithographic press unit. Specifically, the press unit and press delivery can be fully accessed and used substantially without interference from the coater. The pressman also has substantial access to blanket cylinder 122, as well to the ink and dampener rollers. The pressman also has access to the area underneath well 128, housing transfer rollers.

To convert the press unit to a coater, the coating assembly is guided horizontally along shaft 38 toward the blanket roll to free it from brackets 62. Pressure in hydraulic cylinders 46 is regulated so that lift rods 48 retract into the cylinders, allowing plate 22 to drop; in this way, the coating assembly is aligned (in one or more "steps" as shown in FIG. 2) vertically with the final press unit.

Specifically, vertical alignment is achieved when frame 22 seats on the lower horizontal surface 31 of support bar 34. To provide additional stabilization, threaded studs 33 on either side of surface 31 fit in corresponding openings 35 on frame 22, and flange nuts 37 are threaded on stud 33 to lock frame 22 to bar 34 and thereby stabilize the coater.

Once vertical alignment is achieved, the coating assembly is again advanced horizontally until hydraulic cylinder shaft 56 engages the opening in plate 52. Handle 58 and pin 54 are inserted to lock shaft 56 in place. Resiliently biased cylinder 57 absorbs any excess momentum from the moving coating assembly to prevent damage to the press unit. It also enables a pre-set pressure.

To convert the final unit to a standard printing unit, handles 58 and pin 54 are removed, flange nuts 37 are removed, and the carriage is moved horizontally and vertically to support bracket 62.

OTHER EMBODIMENTS

Other configurations and adaptations of the invention fall within the claims. For example, the lifting hydraulic cylinder can be oriented in the opposite direction, so that lift is achieved when the cylinder arm extends downwardly to press against a fixed support. In this case the body of the cylinder would more vertically with the coater unit while the extended shaft or piston would remain with the support. Multiple guide rods can be used to stabilize movement of the base frame.

We claim:

1. Apparatus for applying a liquid coating to the surface of a sheet work piece, said apparatus being adapted for operation on-line with the last unit of an off set lithographic sheet printing press, said press unit comprising a blanket cylinder and a work-piece delivery area, positioned on the opposite end of a well from said blanket cylinder, said apparatus comprising:

(a) a coating metering assembly supported by a platform comprising,
  (i) a rotably mounted applicator roller,
  (ii) coating delivery means positioned to deliver coating to said applicator roller, and
  (iii) a metering member mounted in position to control the amount of coating on said applicator roller; and
(b) a guide assembly adapted to retract said platform and said coating metering assembly away from said lithographic press unit, said guide assembly comprising
  (i) a horizontal member and means for slidably supporting said platform movement along said horizontal member,
  (ii) a vertical member slidably guiding vertical movement of said platform,
  (iii) means for slidably lifting said platform and coating metering assembly on a course guided by said vertical member,

whereby said coating metering assembly and platform can be moved between a first position in which said applicator roller is locked into position to deliver coating to said blanket cylinder of said lithographic press unit, and a second position horizontally and vertically displaced from said first position a distance allowing substantial access between the last press unit and the work-piece delivery area adjacent said last press unit, when said press unit is operating as an offset lithographic press unit.

2. The apparatus of claim 1 wherein said horizontal member comprises a horizontal guide shaft attached along the outside of the press unit, and said platform is adapted to engage a support cooperatively and slidably engaging said horizontal guide shaft.

3. The apparatus of claim 2 wherein said vertical member comprises a vertical guide shaft attached to said support.

4. The apparatus of claim 3 wherein said vertical guide shaft extends from the support, through an opening in the platform, to a bearing block positioned above and attached to said support, said platform slidably engaging said vertical shaft, whereby vertical movement of said platform is guided by said vertical guide shaft.

5. The apparatus of claim 4 wherein said means for slidably lifting said platform and coating metering assembly comprises a lift shaft connected to said platform, extending through said bearing block and further attached to a force transmitting member.

6. The apparatus of claim 5 wherein said force transmitting member is an extension plate attached to the lift shaft.

7. The apparatus of claim 5 wherein said apparatus further comprises a force-delivering means positioned to deliver force to said force receiving member.

8. The apparatus of claim 1 wherein said means for slidably lifting the platform and coating metering assembly comprises a cylinder driven by pressurized fluid.

9. The apparatus of claim 8 comprising a pair of said cylinders, each member of said pair being positioned on opposite sides of said platform, and

fluid pressure supply means connected through a pressure-compensated flow divider to each member of said pair, said flow divider being adapted to maintain equal flow to each member of said pair.

10. The apparatus of claim 5 comprising: (a) at least two horizontal guide shaft, one of said horizontal guide shafts being on each side of the press unit; (b) at least two vertical guide shafts, one of said vertical guide shafts being on each side of said platform, and (c) at least two lift shafts, one of said lift shafts being connected to each side of said platform.

11. The apparatus of claim 3 further comprising a bracket attached to the press work-piece delivery in position to support said platform in said second position.

12. The apparatus of claim 11 comprising a lock positioned to removably lock said platform in said first position.

13. The apparatus of claim 12 wherein said lock comprises threaded attachment means for locking said platform in said first position.

14. Apparatus for applying a liquid coating to the surface of a sheet workpiece, said apparatus being adapted for operation on-line with the last unit of an off set lithographic sheet printing press, said press unit comprising a blanket cylinder and a work-piece delivery area, positioned on the opposite end of a well from said blanket cylinder, said apparatus comprising:

(a) a coating metering assembly supported by a platform comprising,
  (i) a rotably mounted applicator roller,
  (ii) coating supply means for supplying coating to said applicator roller, and
  (iii) metering means to control the amount of coating on said applicator roller; and
(b) a guide assembly adapted to retract said platform and said coating metering assembly away from said lithographic press unit, said guide assembly comprising,
  (i) a horizontal member and means for slidably supporting said platform movement along said horizontal member,
  (ii) a vertical member slidably guiding vertical movement of said platform,
  (iii) means for slidably lifting said platform and coating metering assembly on a course guided by said vertical member,

whereby said coating metering assembly and platform can be moved between a first position in which said platform is locked into position to deliver coating to said blanket cylinder of said lithographic press unit, sand a second position horizontally and vertically displaced from said first position a distance allowing substantial access between said last press unit and the work-piece delivery area adjacent said last press unit, when said press unit is operating as an offset lithographic press unit.

* * * * *

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United States Patent [19]
DiRico

[11] **Patent Number:** 4,685,414
[45] **Date of Patent:** Aug. 11, 1987

[54] **COATING PRINTED SHEETS**

[76] Inventor: **Mark A. DiRico**, 416 Adams St., Quincy, Mass. 02169

[21] Appl. No.: **719,474**

[22] Filed: **Apr. 3, 1985**

[51] **Int. Cl.⁴** **B05C 1/08**; B05C 11/10

[52] **U.S. Cl.** **118/46**; 118/211; 118/262

[58] **Field of Search** 118/46, 262, 261, 211; 101/352

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Primary Examiner—Evan K. Lawrence

[57] **ABSTRACT**

Apparatus for applying a liquid coating to the surface of a sheet workpiece and adapted for operation on-line with the last unit of a lithographic sheet printing press. The apparatus comprises: (1) a textured metering roller in a mount which is linearly movably attached to a support platform fixed adjacent the press unit, and extending between the last press unit and a remote point. The support platform allows movement of the metering roller and the mount between a first position in which the mount is continuously adjustably biased against the last press unit, and a second position, away from the last press unit to allow use of the last press unit as a lithographic press. The platform comprising longitudinal supports arranged generally perpendicular to a vertical plane through the axis of said metering roller, and the metering roller mount is movably supported and guided along the supports.

In the first position, the metering roller continuously delivers a smooth, uniform, metered amount of liquid material to the blanket roller of the printing press. The apparatus also includes a latch that allows the mount, with its attached metering roller, liquid coating supply, and metering roller rotation device, to be readily detached from and moved out of the way of the press unit, so that the press unit can be used as a lithographic press unit. A biasing latch and an adjustable stop allow the metering roller and mount to be readily and reliably returned, locked and biased in the first position.

8 Claims, 4 Drawing Figures

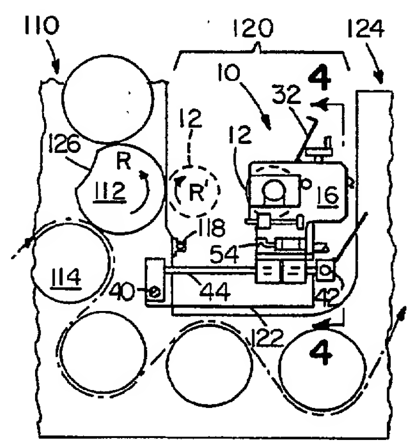
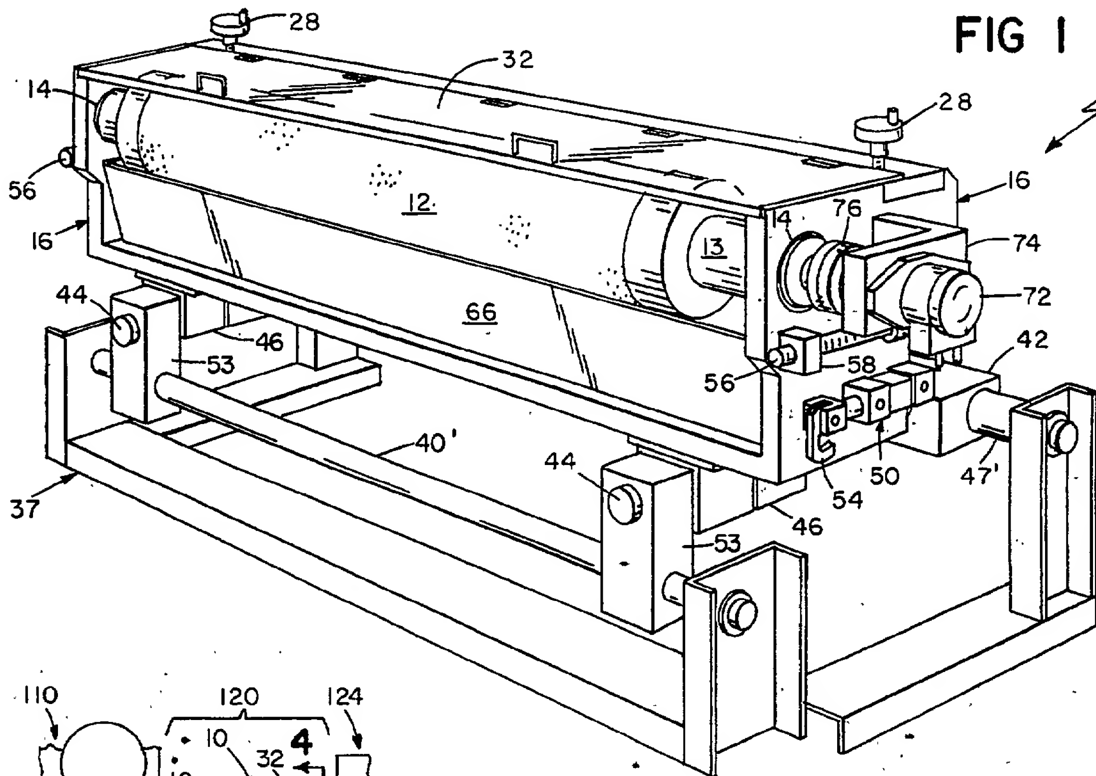
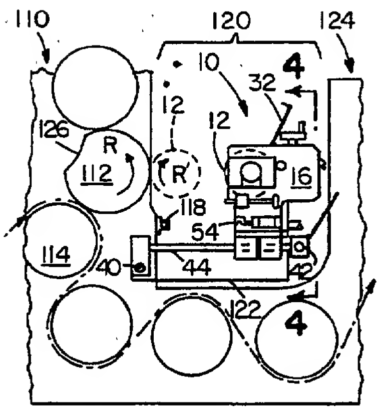


FIG 1





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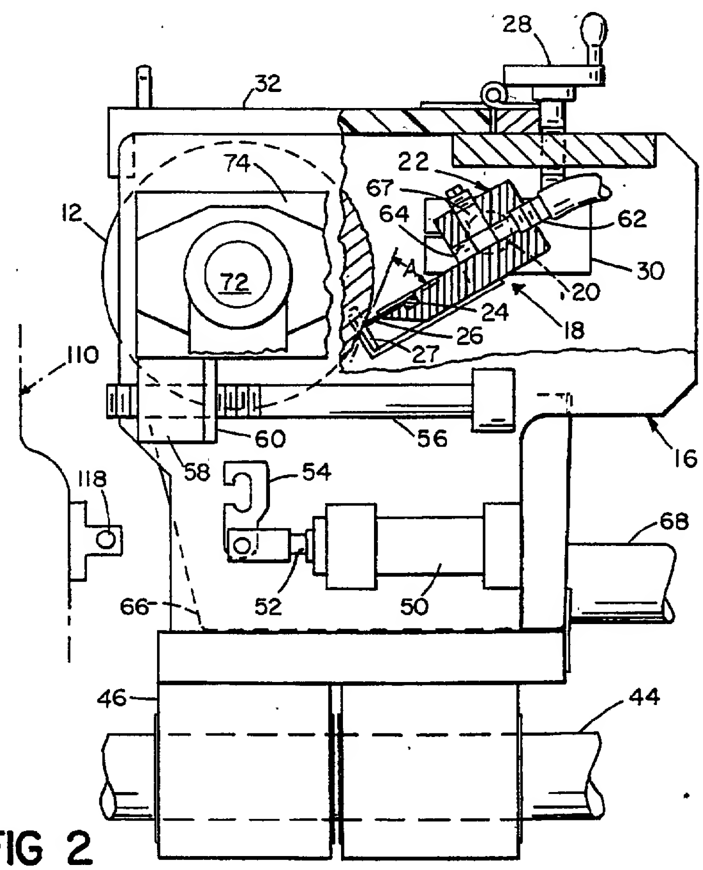

FIG 2

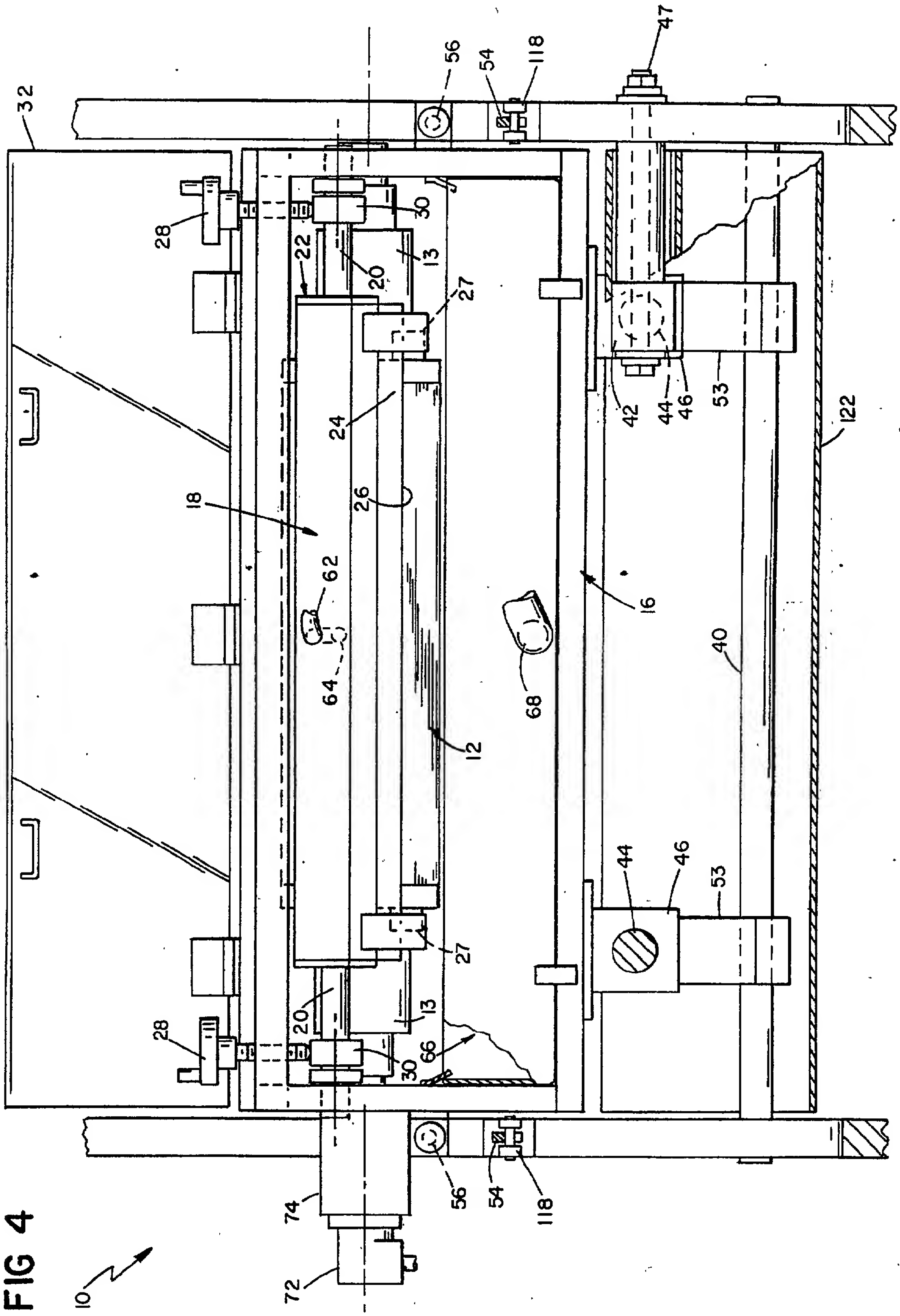
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FIG 4

COATING PRINTED SHEETS

BACKGROUND OF THE INVENTION

This invention relates to coating printed sheets.

In many applications it is desirable to apply a coating to a printed sheet. For example, a water soluble polymer finish may be applied to a workpiece printed by offset lithography to "dry" the sheet quickly by coating the surface while it is still tacky. This coating avoids the need for powder driers that may be cumbersome or air drying procedures that may be slow. Coatings are also useful for providing a glossy finish that improves the rub-resistance of the workpiece and improves its overall appearance. Finally, adhesive coatings may be applied to printed packaging; for example, heat-set adhesives may be applied to enable attachment of a feature such as the clear plastic bubble of a package used to display the product.

Application of coatings to a workpiece is made difficult by various requirements. For example, the coating should be uniform and its thickness should be controlled. Moreover, the coating should be applied quickly, before its vehicle evaporates causing it to thicken. Finally, it is desirable for the coater to operate "on-line" with the press that prints the workpiece to take full advantage of the fast-drying capability of coatings and generally to simplify the manufacture of printed coated workpieces.

Butler U.S. Pat. No. 4,270,483 discloses an on-line coating apparatus for attachment to a conventional offset lithographic printing press. The apparatus includes a set of rollers (i.e. pick-up roller **14** and application roller **16**) to deliver coating material from a reservoir **18** to a blanket roll **108**. A metering rod **40** meters the amount of coating transferred to application roller **16**.

An on-line coater sold by Norton Burdett Co. of Nashua, N.H. has a single roller driven directly by a D.C. motor. The roller is a gravure cylinder that transfers coating to a blanket cylinder. The coater is attached to a pivoting arm, and the unit can be pivoted away from the press unit when the coater is not in use.

Another on-line coater, sold by IVT Colordry, Inc. of Fairfield, Conn., applies coating from a reservoir pan to a blanket cylinder using a pick-up roller that delivers a metered coating supply to an applicator roller; the applicator roller applies the coating to the blanket cylinder of a press unit.

Kumpf U.S. Pat. No. 3,768,438 discloses a coater in which a fountain roller dips into a coating reservoir and transfers liquid coating material to a feed roller. The feed roller in turn transfers coating material to a coating roller that coats a sheet fed between the coating roller and a format roller.

SUMMARY OF THE INVENTION

The invention generally features apparatus to be mounted on-line with a printing press unit for coating the surface of a sheet workpiece with liquid material. The coating apparatus comprises a textured (e.g., engraved) metering roller or cylinder rotably mounted to be forced against the blanket roller of the press unit. A doctor assembly comprising an elongated blade edge is positioned against the engraved roller surface, and includes means to deliver the liquid material to the longitudinal engraved surface of the roller. The engraved metering roller delivers a metered amount of the liquid to the blanket roller, which transfers the liquid material to the sheet workpiece.

Preferred embodiments of the apparatus include the following features. A hydraulic cylinder mounted on the coating apparatus pulls a piston rod that is clamped to the press unit, thus forcing the metering roller against the blanket roller. The printing press is an offset lithographic press having an indented region on the blanket roller surface, and the mounting means includes a stop to limit movement of the metering roller toward that indented region. The mounting means is movably attached to a platform so the coating apparatus is moveable away from the printing press unit when the coating apparatus is not in use. Specifically, the mounting means has bearings that slide along longitudinal support rails arranged to be generally perpendicular to a vertical plane through the metering roll axis. The doctor assembly includes means to deliver liquid coating from a liquid coating reservoir to an outlet positioned to deliver coating liquid to a central portion of the engraved surface adjacent the doctor blade; the outlet is positioned so that as the metering roll rotates, coating delivered from the outlet encounters the doctor blade before it encounters the blanket roller. The position of the doctor blade can be adjusted relative to the metering roll surface. A drip pan positioned below the doctor blade has an outlet to drain and recirculate coating material that flows from the ends of the metering roller and doctor assembly. A hydraulic motor is mounted to drive the metering roller directly, rotating it in a predetermined rotational direction.

The apparatus provides a compact, versatile and reliable means for coating printed sheets. Specifically, the apparatus can be added to an existing press unit without significant modification to the unit; and once added, the apparatus can be moved out of the way so that the press unit to which it is attached can be used for printing. This is particularly useful when the number of colors to be printed requires the use of the press unit to which the coater is attached.

The apparatus is capable of delivering a metered amount of coating to the blanket roller without the use of bulky complex metering systems and without serious clogging of the coating flow path. Versatility is achieved by using the blanket roller of an existing press unit, yet the apparatus can be detached easily from the press unit and moved out of the way. At the same time, when it is in use, the apparatus is stable and provides a steady even pressure against the blanket roller, notwithstanding the considerable range of forces and vibrations to which the metering roller is subject. The apparatus accommodates indentations in the blanket roller without suffering uneven compressive forces that could "squeeze" liquid coating from the blanket and cause streaking. Finally, the use of the hydraulic assist motor with a direct drive enables a smooth start up, delivering an even amount of coating to the blanket roller quickly after start-up without streaking that can be experienced with other drive systems.

Other features and advantages of the invention will be apparent from the following description of the preferred embodiment and from the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a coating apparatus supported independently and not attached to a press unit.

FIG. 2 is a side view of the coater of FIG. 1, with parts broken away and in section, including a portion of an adjacent press unit.

FIG. 3 is a highly schematic representation of the coater of FIG. 1 attached to a press unit.

FIG. 4 is a rear view of the coater of FIG. 1 with parts broken away and in section.

APPARATUS

FIG. 1 shows coating unit 10 separated from a press, as it would be in storage or in construction. As shown in FIGS. 2 and 3, coating unit 10 is adapted to attach to the most downstream unit 110 of a standard multi-unit offset lithograph press. Coating unit 10 has a single engraved roller 12 and shaft 13 rotably mounted on bearings 14 that are attached to a housing 16. When the coating unit is attached to press unit 110, the axis of roller 12 is parallel and horizontally aligned with the axis of blanket roller 112, and roller 12 contacts the blanket roller 112 so that roller 12 delivers liquid coating to blanket roller 112.

As shown best in FIG. 2, a doctor blade assembly 18 is adjustably mounted in housing 16 to deliver liquid coating to engraved roller 12 and to spread a metered level of the coating along the roller surface. Assembly 18 includes a rotably mounted axle 20 spanning housing 16 parallel to the longitudinal axis of roller 12. Mounted centrally on axle 20 is a rectangular housing 22 from which a blade clamp 24 extends. Doctor blade 26 is fixed in clamp 24 and is held against roller 12 at an angle. Blade 26 is blue spring steel about 0.007 inches thick, and it extends from clamp 24 about ½ inch. The set-up angle A (FIG. 2) is about 30°. Blade 26 is forced against roller 12 at a pressure of e.g. 25–30 pounds for a 60-inch blade (i.e. about 0.5 pounds per inch).

In FIG. 2, doctor blade assembly 18 also includes a fitting 62 communicating with a passage through doctor blade housing 22 to outlet 64. A plugged passage 67 in housing 22 allows access to the interior of the housing for cleaning. A drip pan 66 having an outlet 68 is positioned below roller 12 and doctor blade assembly 18.

Adjustment of blade 26 to roller 12 is achieved by two adjustment screws 28 which extend through the top of housing 16 at opposite ends thereof. Screws 28 extend to adjustment brackets 30 on axle 20. Because screws 28 are attached to brackets 30 at points off of the center of the axle 20, rotation of screws 28 will pivot axle 20 and brackets 30, changing the pressure between blade 26 and roller 12. Wipers 27 on assembly 18 at each end of roller 12 prevent liquid coating from building up on the ends of the roller 12.

Unit 10 also includes a clear cover 32 hinged to the top of housing 16 to protect roller 12.

As shown in FIGS. 3 and 4, housing 16 is movably mounted above the floor 122 of the well 120 between press unit 110 and downstream unit 124, which is, e.g., a rack for storing bundles of the finished workpieces. Specifically, housing 16 is mounted on bearing blocks 46 that slide on two parallel tie rods or rails 44 oriented perpendicular to the axis of roller 12. Rails 44 are supported at one end by blocks 53 that are adjustably mounted on cross shaft 40 of press unit 110. At their other ends, rails 44 are supported respectively by blocks 42 on shafts 47 fixed to press unit 110. As best shown in FIG. 3, shaft 40 and shafts 47 are integrated with the floor 122 of well 120. Shaft 40 is an existing shaft on unit 110. Shafts 47 are added to the unit to accommodate coater 10. (In FIG. 1, the coater 10 is shown separate from unit 110, as it might be stored or transported; rails 44 are supported by a frame 37 of metal beams that support shaft 40' and shafts 47').

Hydraulic cylinders 50 (one shown) are mounted on opposite sides of housing 16 to drive piston arms 52 and maintain proper pressure between roller 12 and roller 112. At one end of each piston arm 52 is a latch 54 that cooperates with a lug 118 on unit 110 to latch the coating unit to the press. Also fixed to each side of housing 16 is an adjustable stop screw 56 that is threaded through a block 58 and locked in place with lock nut 60. Cylinders 50 are connected to limit switches (not shown) to release the pressure between rollers 12 and 112 when the press is off impression.

On one side of housing 16 a hydraulic motor 72 is mounted to motor support 74 to drive roller 12 directly via coupling 76.

OPERATION

The coater is first locked into operation on press unit 110 by manually moving it along rails 44 toward unit 110 and rotating latch 54 to engage a lug on unit 110. In operation, when the press is off impression, hydraulic motor 72 rotates roller 12 as coating fluid is pumped under pressure from a fluid reservoir (not shown) to inlet opening 64 in the doctor blade assembly. From there, coating spreads over the engraved surface of roller 12 and is metered by the engraving and by doctor blade 26. A continuous flow of coating is maintained over the surface of roller 12, and excess coating is recovered through drip pan 66 and outlet 68 for recycling. In this way, sufficient flow is maintained to avoid clogging the flow path or roller with dried coating and to avoid starving the ends of the roller. The amount of coating carried by roller 12 can be adjusted by turning screw 28 to adjust the pressure between blade 26 and roller 12, as described above. When the press is on impression, hydraulic cylinders 50 serve to pull roller 12 against blanket roller 112 with a force that can be adjusted by adjusting the pressure in cylinders 50. As blanket rotates in direction R, friction turns roller 12 in the opposite direction R', without assistance from the motor 72.

As blanket roller 112 rotates, the indentation 126 on that roll encounters the nip between roller 12 and roller 112. It is undesirable to allow roller 12 to be forced into that indentation 126 by hydraulic cylinders 50. Stops 56 are adjusted to limit travel of coater housing 16 and prevent that from occurring. Stops can be finely adjusted to set the optimum pressure (for example about 40–50 pounds/linear inch) between roller 12 and roller 112.

A metered amount of liquid coating is delivered to blanket roller 112 at the nip between roller 112 and roller 12. Blanket roller 112 in turn delivers that coating to the workpiece as the workpiece travels through the nip between roller 112 and impression roller 114.

When the coater is not in use, latch 54 is released, and the coater is moved back along rods 44 away from roller 112.

More specifically, when using an acrylic water-based coating, a suitable engraved roller is a quadrangular cell cylinder, having about 165 lines/inch, each cell being about 60 microns in depth. Machine Engraving Division. Southern Gravure Service, Inc., Louisville, Ky., sells a suitable engraved roller. An acrylic water-based coating having about 25% solids can be applied to

achieve a dry coat weight of 0.6–0.9 pounds using a roll speed of about 350 rpm.

OTHER EMBODIMENTS

Other embodiments are within the following claims. For example, other doctor blade arrangements can be used to meter the load on roller 12; such as a system having dual, parallel blades having a coating inlet between the two blades. Other types of engraved cylinders may be used. Other types of press units may be used in conjunction with the coater, but offset lithographic sheet-feeding units are preferred.

I claim:

1. Apparatus for applying a liquid coating to the surface of a sheet workpiece, said apparatus being adapted for operation on-line with the last unit of a lithographic sheet printing press, said unit comprising a blanket roller having a surface indentation, said coating application apparatus comprising:

(1) a metering roller rotatably mounted in mounting means, said metering roller having a textured longitudinal surface, said mounting means being linearly movably attached to a support platform fixed adjacent said last press unit, and extending between the last press unit and a point remote from said unit, allowing movement of said metering roller and said mounting means between a first position in which said mounting means is continuously adjustably biased against said last press unit wherein said metering roller surface contacts said blanket roller, and a second position, away from said last press unit to allow use of said last press unit as a lithographic press, said platform comprising longitudinal supports arranged generally perpendicular to a vertical plane through the axis of said metering roller, said metering roller mounting means being supported by, guided by and movable along said supports;

(2) latch means, attached to the mounting means and positioned to lock said metering roller mounting means to said press unit in said first position, said latch means comprising a biasing means to adjustably bias said metering roller mounting means against said press unit, providing a steady even pressure between said blanket roller and said metering roller, wherein said mounting means further comprises a continuously adjustable stop to position said metering roller against said blanket roller and to prevent travel of said metering roller toward said surface indentation of said blanket roller as said blanket roller rotates, said latch being movable to provide quick release of said mounting means from said press unit to allow movement along said supports to said second position; and

(3) a metering member comprising means to control liquid coating on said textured metering roller surface;

(4) means attached to said mounting means to supply liquid coating material to the textured surface of said metering roller; and

(5) means attached to said mounting means to effect rotation of said metering roller;

whereby in said first position, said metering roller continuously delivers a smooth, uniform, metered amount of said liquid material to said blanket roller, said blanket roller transferring said liquid material to said sheet workpiece, said latch allowing said mounting means, with its attached metering roller, liquid coating supply means, and metering roller rotation means, to be readily detached from and moved out of the way of the press unit, so that the press unit can be used as a lithographic press unit, and said latch means and adjustable stop allowing said metering roller and mounting means to be readily and reliably returned,locked and biased in the same said first position.

2. The apparatus of claim 1 wherein said metering member comprises a doctor assembly, said assembly comprising an elongated blade edge positioned against said textured roller surface, said assembly further comprising said means to deliver said liquid coating material to said textured roller surface.

3. The apparatus of claim 1 wherein said latch means comprises a cylinder attached to said mounting means that adjustably forces said mounting means against said press unit.

4. The apparatus of claim 1 wherein said longitudinal supports comprise rail members, and said mounting means comprises bearings that slide along said rail members.

5. The apparatus of claim 2 comprising a drip pan positioned below said doctor assembly attached to said mounting means, said drip pan comprising an outlet to drain and recirculate excess liquid coating material that flows from the ends of said metering roller, said doctor assembly comprising means to hold said elongated blade and adjust the blade pressure against the metering roller, said liquid coating delivery means comprising a centrally positioned outlet to deliver coating recirculated from said drip pan.

6. The apparatus of claim 3 wherein said latch means comprises a lug mounted on said press unit positioned to cooperate with said cylinder, said cylinder being a hydraulic cylinder, said latch further comprising a quick-release interconnect between said lug and said cylinder.

7. The apparatus of claim 6 wherein said latch means comprises a pivoting member that pivots between a first position attached to said lug and a second position that releases said coater from said press unit.

8. The apparatus of claim 7 wherein said latch means comprises a hook member configured to pivotally engage said lug on said press unit.

* * * * *

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US005107790A

United States Patent [19]

Sliker et al.

[11] **Patent Number:** **5,107,790**

[45] **Date of Patent:** **Apr. 28, 1992**

[54] **TWO HEADED COATER**

[75] Inventors: **Larry J. Sliker**, Livonia; **Robert S. Conklin**, Rochester, both of N.Y.

[73] Assignee: **Rapidac Machine Corp.**, Rochester, N.Y.

[21] Appl. No.: **463,115**

[22] Filed: **Jan. 11, 1990**

[51] **Int. Cl.**[5] **B05C 1/08**; B05C 11/00

[52] **U.S. Cl.** **118/674**; 118/46; 118/212; 118/249; 118/255; 118/258; 118/262

[58] **Field of Search** .... 118/674, 46, 249, 255, 118/258, 262, DIG. 1; 101/247, 329, 352

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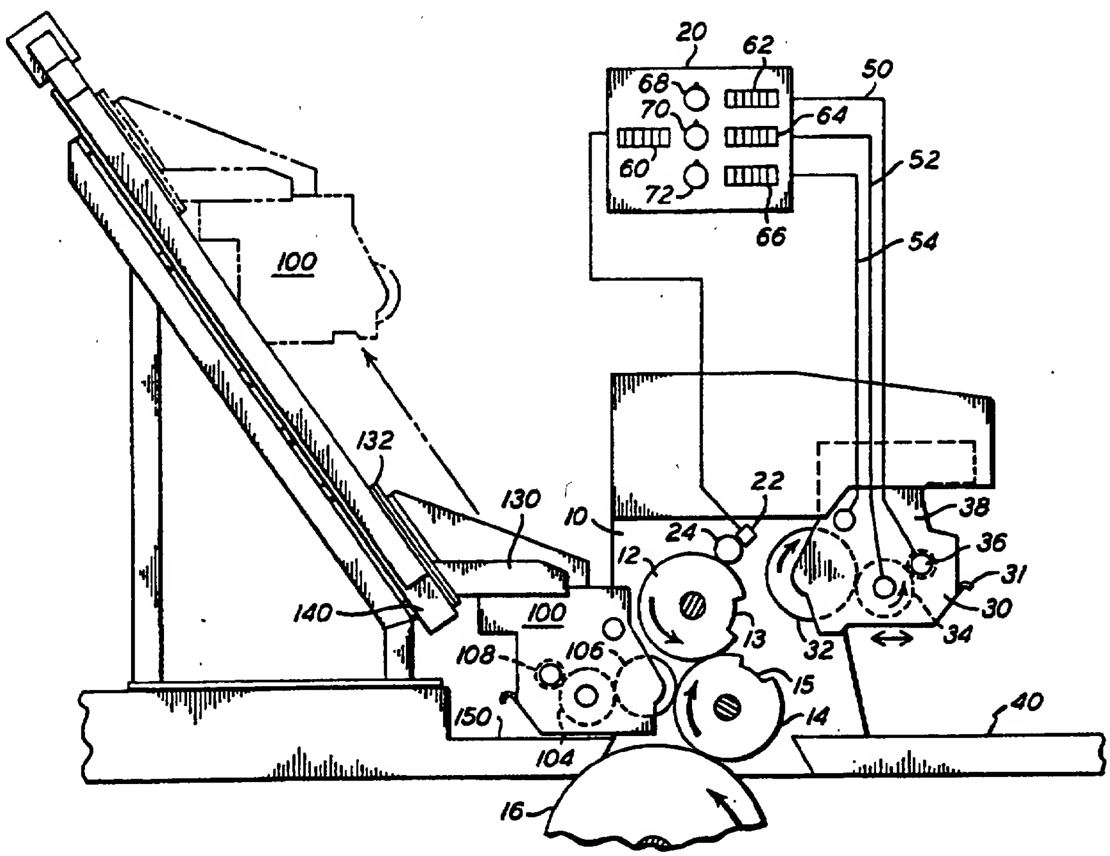
Primary Examiner—Michael G. Wityshyn
Attorney, Agent, or Firm—Cumpston & Shaw

[57] **ABSTRACT**

Coating apparatus for applying continuous or spot coatings to an image printed surface includes a plate cylinder; a blanket cylinder for transferring a coating material from the plate cylinder to the copies; a blanket coating roller for transferring a continuous layer of coating material to the blanket cylinder; a plate coating roller for selectively applying spot coating material to the plate cylinder; a first retractor for moving the blanket coating roller laterally into and out of transferring engagement with the blanket cylinder; and a second retractor for moving the plate coating roller into and out of transferring engagement with the plate cylinder.

14 Claims, 3 Drawing Sheets



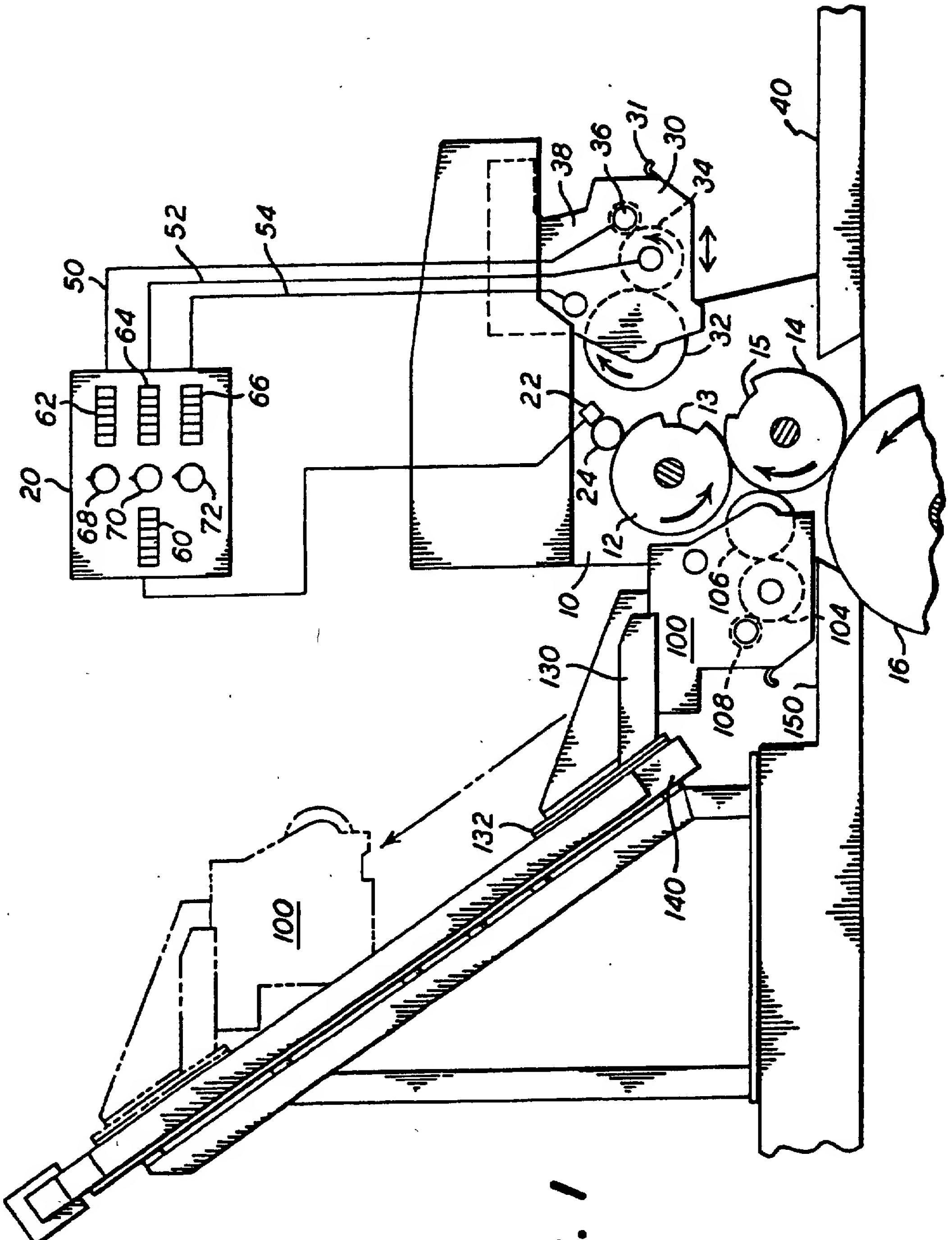

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FIG. 1

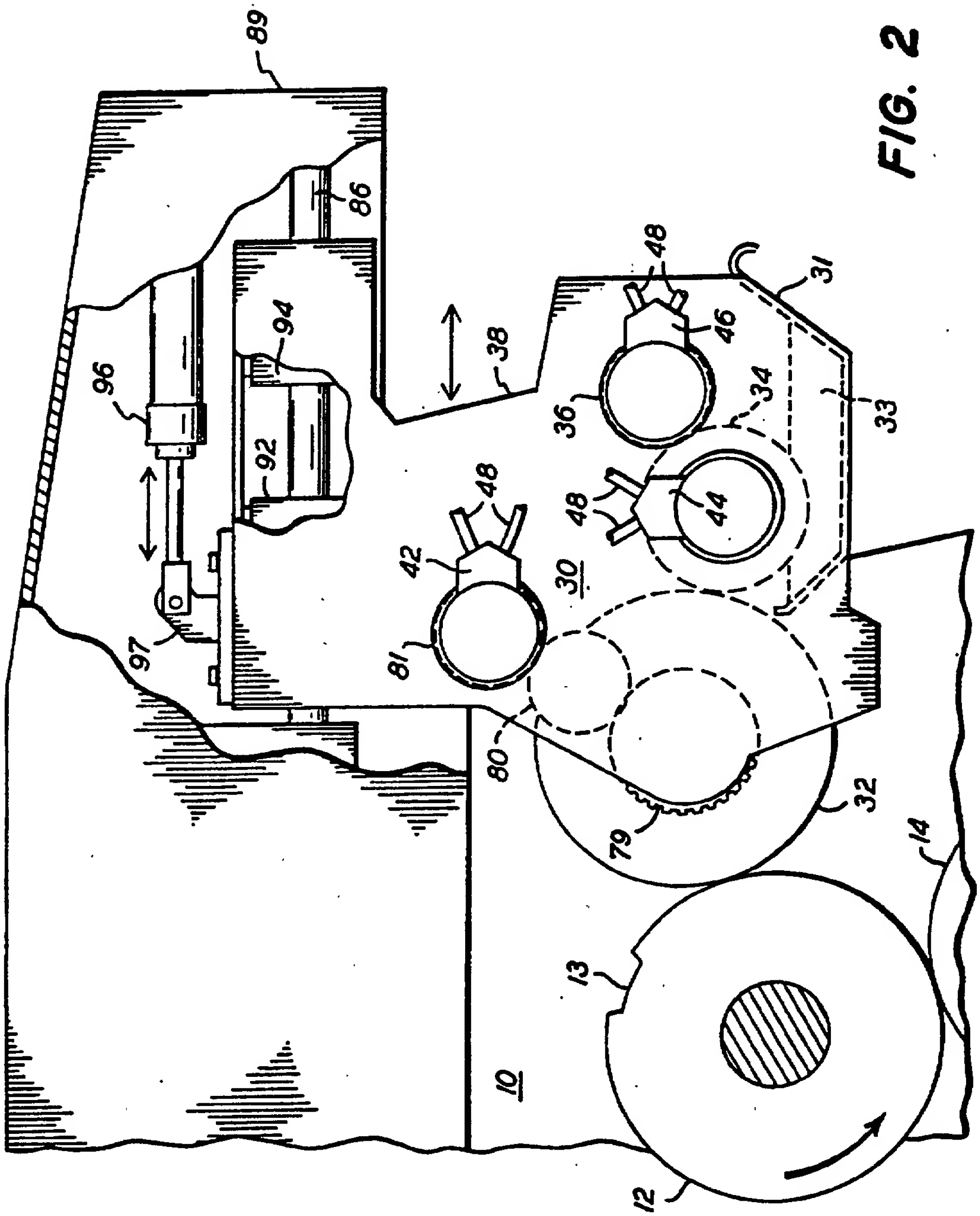
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FIG. 2

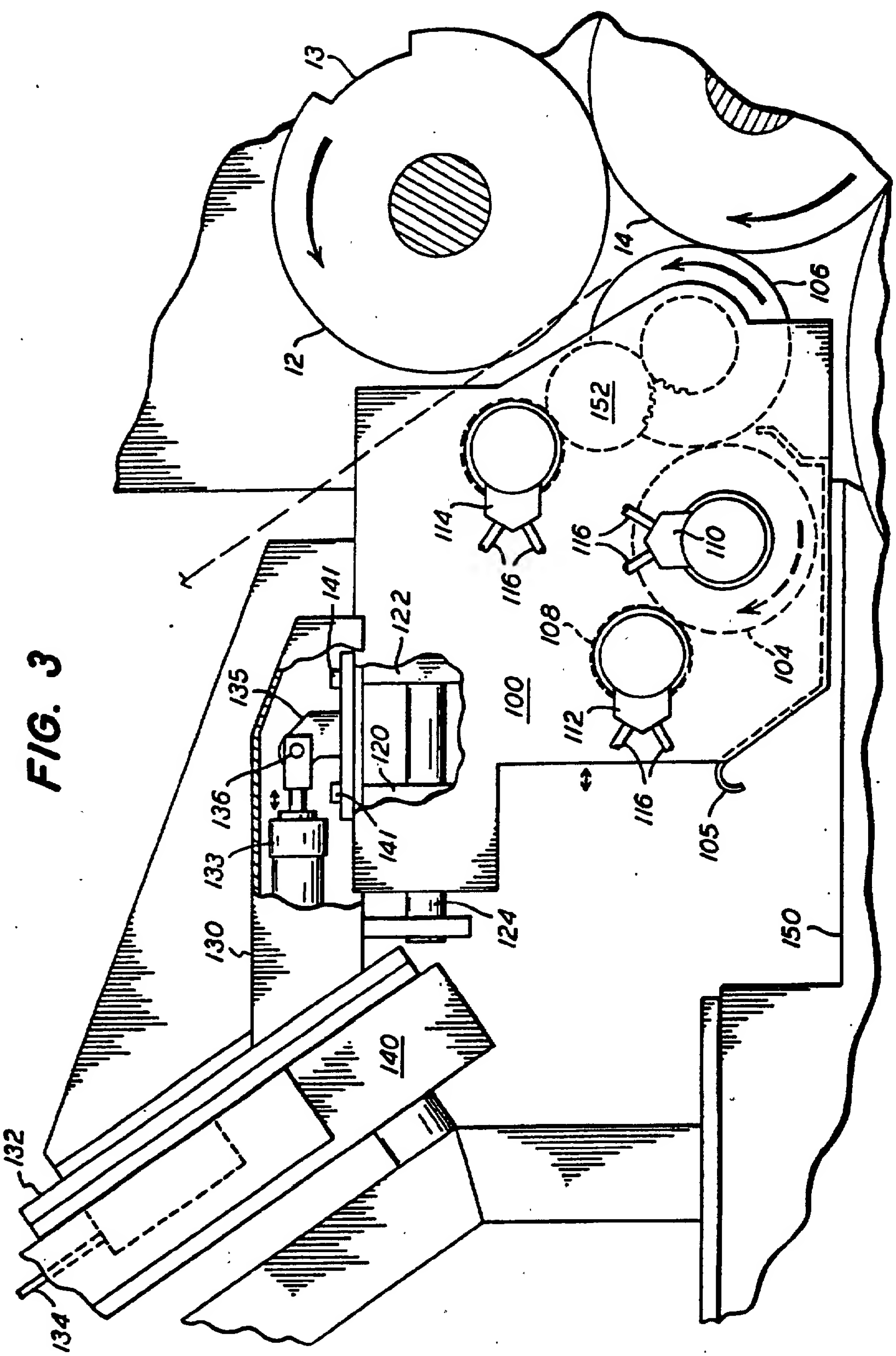
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FIG. 3

TWO HEADED COATER

This invention relates in general to coating apparatus for printing presses, and more particularly to a dual headed coater adapted to provide overall or spot coating on a printed sheet or web as a final or near final step in the printing process.

The advantages of coating printed sheets are well known, and much effort has been expended in providing satisfactory apparatus for carrying out the coating process. Among the many patents relating to coating apparatus are U.S. Pat. Nos. 4,615,293, 4,569,306, 4,685,414, 4,446,814, 4,421,027, 4,399,767, 4,397,237, 4,308,796, 4,270,483, and 3,931,791.

For flexibility and to reduce costs, printing presses are often assembled from a plurality of substantially identical printing units, the number of units used being determined by the number of colors to be printed. Each printing unit applies a different color ink to the sheet or web to form the printed image. It is advantageous, to reduce costs, and maintain flexibility in adapting the press to different jobs, to provide coating apparatus that may be selectively engaged with the plate or blanket cylinders of an existing printing unit to carry out the coating operation and disengaged so that the printing unit can be used for its normal purpose or allowed to idle when coating is not required.

Among the patents mentioned above, Jahn U.S. Pat. No. 4,615,293 shows a medium applicator for a printing machine. The medium applicator (coater) is disposed downstream of the printing units of the machine, and includes two applicator rollers, one contacting the roller that would function as the plate roller in a conventional printing unit and the other contacting the blanket cylinder. The coating rollers are disposed on the upstream side of the plate and blanket cylinders respectively of the coating assembly.

Although the coating apparatus described in the Jahn patent is theoretically capable of carrying out the spot and blanket coating operations as described, in practice, the arrangement shown in the Jahn patent is impractical, and would be of little use in a large scale printing application.

Printers can produce high volumes of printed material rapidly through the use of modern printing presses. The presses are extremely expensive, and the amount of time required to reconfigure the press from one job to another is non-productive, and costly. Accordingly, there is a need for presses and associated coating apparatus that minimize the time required to clean up from one run, and set up and commence the next run. Although versatile coaters that can apply spot and blanket coatings are desirable, ordinarily only one coater at a time is actually in operation. Where consecutive jobs require the same sort of coating, particularly blanket coating, it may not be necessary to clean up the coater between jobs. However, the coating lacquers cannot be allowed to dry on the rollers, and therefore, especially when switching from blanket to spot coating or vice-versa, or if there is a wait between jobs, it is necessary to clean up the coaters after each job is completed. In addition, cleanup is necessary when switching between different coating compositions, such as aqueous and u-v coatings. Such coatings are incompatible, and the coaters must be cleaned between applications of such different coatings.

Modern high speed printing presses are dangerous to work around in ordinary circumstances, and are particularly dangerous when operating at full speed. It would be virtually impossible to clean the prior art coaters such as the coater shown in the Jahn patent while the press is operating, and especially difficult for example to clean the blanket coater while printing spot coatings on a subsequent job.

Accordingly, it is an object of this invention to provide coating apparatus for applying continuous or spot coatings to an image printed surface comprising: a plate cylinder; a blanket cylinder for transferring a coating material from the plate cylinder to the copies; a blanket coating roller for transferring a continuous layer of coating material to the blanket cylinder; a plate coating roller for selectively applying spot coating material to the plate cylinder; first retracting means for moving the blanket coating roller laterally into and out of transferring engagement with the blanket cylinder; and second retracting means for moving the plate coating roller into and out of transferring engagement with the plate cylinder.

It is another object of this invention to provide coating apparatus of the type described and further including tachometer or other means responsive to the rotation of the plate and blanket cylinders for providing speed signals proportional to the press speed and control means responsive to the speed signals for controlling the speed of the plate and blanket coating rollers.

It is another object of this invention to provide drive means for the plate and blanket coating rollers, and independent controllers for each of the drive means permitting the relative speeds of the plate and blanket coating rollers and plate and blanket cylinders respectively, to be continuously controlled to adjust the shear at the nip between the rollers and the cylinders at various press speeds for enhancing the coating operation.

It is still another object of this invention to provide a retracting assembly for moving one of the plate and blanket coating rollers horizontally into and out of engagement with one of the plate and blanket cylinders, and for lifting the coating roller assembly away from the cylinder for easy access during cleaning.

It is still another object of this invention to provide means for translating the other coating roller into and out of engagement with the other cylinder, the out of engagement position adapted to permit cleaning of the roller and associated apparatus.

It is a still further object of this invention to provide control means responsive to sensing tachometers or other means providing signals proportioned to press speed coupled to the plate and blanket cylinders for controlling the rotation of the coating rollers and associated pick up and metering rollers for controlling the amount of coating material applied to the printed page.

It is a still further object of this invention to provide control means for incrementally adjusting the relative speed of the pickup, metering, and coating rollers relative to the speed of the plate and blanket cylinders.

It is a feature of this invention that coating rollers can be employed, because of the placement thereof on opposite sides of the press unit, that are larger in diameter than those utilized in prior art coaters. The use of large diameter coating rollers reduces the speed of rotation of the rollers, and thereby the tendency of the rollers to sling coating material off the surface by centrifugal force. This is especially advantageous in pattern or spotting coating operations, where the surface speeds of

the applicator roller and plate cylinder must be the same. The use of larger rollers reduces the centrifugal force produced at the surface of the applicator roller, thus greatly reducing the slinging or misting of coating material, when the present invention is employed. Slinging or misting of coating material greatly increases the difficulty of cleanup after a coating operation.

While the novel aspects of the invention are set forth with particularity in the appended claims, the invention itself, together with further objects and advantages thereof, may be more readily understood by reference to the following detailed description of the invention, taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a side elevation of a two headed coater in accordance with this invention;

FIG. 2 is an enlarged segmental side elevation of the plate coating assembly of the two headed coater of FIG. 1; and

FIG. 3 is a segmental side elevation of the blanket coating assembly of the two headed coater of FIG. 1.

Referring now to FIG. 1, a simplified view of a printing unit, preferably the last unit, of a multi-stage offset printing press is illustrated with the coating apparatus of the invention operatively associated therewith. The coating apparatus of this invention is specially adapted to allow it to be retrofitted to a variety of printing units, either during manufacture, or after a press has been installed in a print shop. The damping and inking systems employed in a conventional printing unit are not shown. They may be omitted if the coating unit is designed solely for coating, removed, or simply disengaged or not used in a printing unit retrofitted for coating in accordance with this invention. The unique construction of the two headed coater of this invention permits the coating rollers to be moved into contact with the plate cylinder and blanket cylinder of the converted printing unit, and to be withdrawn to accessible positions for cleaning when not in use.

Printing unit 10 includes a plate cylinder 12 and a counter rotating blanket cylinder 14. As used herein, plate and blanket cylinder refer to the assemblies including plates and blankets, and associated clamps and the like, that are disposed in recesses 13 and 15 shown schematically in the drawing for simplicity. Blanket cylinder 14 contacts an impression cylinder 16 under some pressure and the printed sheet is normally passed through the nip between the blanket and the impression cylinders in a manner well understood by those skilled in the art. Conventional drive means, including cylinder gear wheels, a main driver motor and associated controls, not shown, synchronize the rotation of the plate cylinder, blanket cylinder, and impression cylinder, with the rest of the press.

A controller 20 continuously monitors the press speed through the use of a speed sensor, such as tachometer 22, which may be an optical encoder having a wheel 24 arranged to bear against the plate cylinder (or the blanket cylinder if it is more accessible) for providing a continuous speed signal to controller 20. As used herein, the term tachometer is intended to encompass any device that provides a signal from which the relative speed of the press may be determined. Many presses incorporate such devices internally, and the outputs from internal tachometers of whatever sort are often suitable as speed signals for the coaters of the present invention.

Turning now to the spot coater assembly of the invention, the assembly 30 includes a coating roller 32, a pick up roller 34, and a metering roller 36, all journalled in a conventional fashion in a laterally translatable frame 38 as will be more fully described in connection with FIG. 2.

Referring to FIG. 2, pickup roller 34 is adapted to be at least partially immersed in a container 31 of coating material, such as lacquer 33. The container is omitted from FIG. 1 of the drawing, so as not to obscure the remaining elements. Pick up roller 34 rotates counter clockwise, and metering roller 36, by virtue of the spacing at the nip and the relative speed thereof with respect to the pickup roller, controls the amount of coating material transferred to the coating roller 32 from pickup roller 34. Spot coating assembly 30 is shown in its retracted position in FIG. 1. In this position the assembly is accessible for cleaning, even while the press is running. To this end, a work space is provided adjacent to the coating assembly on a platform 40 on which an operator may stand, to gain access to the spot coating assembly for service and cleaning.

Referring now to FIG. 2, the spot coater 30 is shown in its operating position with coating roller 32 engaging plate cylinder 12. Each of the rollers 32, 34, and 36 of the spot coating assembly 30 is driven by a separate hydraulic motor 42, 44 and 46 respectively. Conventional hydraulic lines 48 convey pressurized hydraulic fluid from a pump and controller valves to the motors and provide for a return to the pump (not shown). The control valves are connected to controller 20. A speed sensor is provided on each of hydraulic motors 42, 44 and 46. The speed sensors are connected to controller 20 via sensing lines 50, 52 and 54. Controller 20 preferably includes conventional displays such as digital for the press speed 60, metering roller speed 62, pickup roller speed 64, and plate coating roller speed 66. The speed of each of the metering, pickup and coating rollers is adjustable by means of controls 68, 70 and 72 respectively that are coupled to the controller valves. In addition, controller 20 is responsive to the press speed as sensed by tachometer 22 for correspondingly increasing or decreasing the speeds of the motors driving pickup, metering and coating rollers, so as to maintain synchronization with the press. It will be understood that synchronization does not necessarily mean that all of the rollers are driven in such a manner as to provide zero slip (relative speed) at the nips, but rather that the desired conditions, which may include relative shear at the nips, are maintained as the press speed is increased. In accordance with a presently preferred embodiment of the invention, the relative speeds of the rollers are set while the press is running at a low speed, and the controller 20 adjusts the speeds of the motors driving the pickup, metering and coating rollers, to maintain the same relative speed as the press speed increases. By adjusting controls 68, 70 and 72, the relative speeds may be fine tuned at any press speed.

As shown in FIG. 2, pickup roller 34 and metering roller 36 are driven directly by hydraulic motors 44 and 46 respectively, while coating roller 32 is driven indirectly by the motor via gear wheels 79, 80, and 81. Those skilled in the art will recognize that the precise manner in which the rollers are driven may be changed to accommodate different arrangements, the particular arrangement shown in FIG. 2 therefore representing only an example of a presently preferred embodiment of the invention.

Frame 38 of spot coating assembly 30 is laterally translatable on horizontally disposed traverse rod 86 rigidly mounted in a support 89, which is attached to coating unit 10. Frame 38 is attached to bearing blocks 92 and 94, that slidably engage rod 86. Linear hydraulic actuator 96 is attached to bracket 97 of frame 38 at one end, and to support 89 at the other, for laterally translating coating assembly 30 into and out of engagement with plate cylinder 12 as illustrated in FIGS. 1 and 2 respectively.

While plate coating assembly 30 is supported on a cantilevered arm of support 89 in accordance with a presently preferred embodiment of this invention, other functionally equivalent arrangements might be useful on printing stages having different configurations from the ones shown.

Referring now to FIGS. 1 and 3, the blanket coating assembly 100 of the invention is shown. Like the spot coating assembly, blanket coating assembly 100 includes a pickup roller 104 extending into a tray 105 adapted to contain a supply of coating liquid, such as lacquer or the like. Pickup roller 104 rotates clockwise and transfers the coating liquid onto blanket coating roller 106 in an amount determined by metering roller 108. The pickup, metering and blanket rollers are driven by hydraulic motors 110, 112 and 114 respectively, either directly or via gear wheels in like manner to the plate coater already described. The motors are supplied with pressurized hydraulic fluid through lines 116 in the manner already described in connection with the plate coating assembly 30. Similarly, speed sensors, not shown, are operatively engaged with each of the rollers or the motors to provide feedback signals representing the rotational speed of the rollers.

Blanket coating assembly 100 is carried by bearing blocks 120 and 122 slidably mounted on traverse rod 124, which is rigidly attached to cantilever arm 130 of carriage 132. Linear hydraulic actuator 133 has one end 136 coupled to a bracket 138, which is attached to blanket coating assembly 100 by bolts 141, or in other convenient fashion. Operation of actuator 134 translates plate coating assembly 100 into and out of engagement with blanket cylinder 14. Carriage 132 is attached to lifting cable 134, which extends up track 140 to conventional lifting means (not shown) to permit blanket coating assembly 100 to be raised to the position shown in phantom in FIG. 1, for cleaning or other servicing. Conventional means, such as a linear hydraulic actuator attached to cable 134, are employed to pull carriage 132 to the raised position. It will be appreciated by reference to FIG. 3, that it is necessary to laterally translate assembly 100 to the left before raising the carriage, in order that blanket coating roller 106 will clear the periphery of plate cylinder 12, as the carriage is raised.

When the carriage is raised, space is created on platform 150 for an operator to service blanket coating assembly 100.

It will be understood that a second controller unit similar to controller 20 is provided for controlling the rotation of pickup roller 104, metering roller 108 and coating roller 106. This controller is not shown in the drawings, because the connections thereto would obscure the remaining elements of the invention and are in any event identical to those already shown and described in connection with the plate coater. As was the case in connection with spot coater 30, hydraulic motor 14 drives coating roller 106 through an intermediate gear 152 in conventional fashion.

While the invention has been described in connection with a presently preferred embodiment thereof, those skilled in the art will recognize that certain modifications and changes may be made therein without departing from the true spirit and scope of the invention, which accordingly is intended to be defined solely by the appended claims.

What is claimed is:

1. Coating apparatus for applying continuous or spot coatings to a plate cylinder and a blanket cylinder of a printing press in which the plate cylinder is disposed generally above the blanket cylinder and arranged so that either of a plate coater and a blanket coater can be serviced while the other coater is operating;

- a retractable blanket coater disposed on one side of the plate and blanket cylinders for transferring a layer of coating material to the blanket cylinder;
- a retractable plate coater disposed on a side of the plate and blanket cylinders opposite the blanket coating roller for applying coating material to said plate cylinder;
- blanket coater retracting means for moving said blanket coater between an operating position in contact with said blanket cylinder and a service position out of contact with the blanket cylinder;
- plate coater retracting means for moving said plate coater between an operating position in contact with said plate cylinder and a service position out of contact with the plate cylinder; and
- lifting means for lifting the blanket coater away from the blanket cylinder so that when one of the plate and blanket coaters is operating and the other is out of contact, the out of contact coater may be serviced without interfering with the operation of the operating one of the plate and blanket coaters.

2. The coating apparatus of claim 1 in which the plate coater comprises a plate coating roller and in which the blanket coater comprises a blanket coating roller and a plate coater motor for rotating said plate coating roller; a blanket coater motor for rotating the blanket coating roller; and also comprising

- speed sensor means for providing a press speed signal; and
- control means responsive to the press speed signal for controlling the speed of the plate coater motor and the blanket coater motor.

3. The coating apparatus of claim 2 wherein sid speed sensor means comprises tachometer means coupled to one of the plate cylinder and the blanket cylinder.

4. The coating apparatus of claim 2 further comprising a pickup roller for transferring a coating liquid to the plate coating roller and a metering roller for controlling the amount of coating liquid transferred to the plate coating roller.

5. The coating apparatus of claim 4 further comprising motor means for rotating the pickup roller and the metering roller.

6. The coating apparatus of claim 5 wherein said control means is connected to sid motor means for varying the speed of the pickup roller and the metering roller in response to the press speed signal.

7. The coating apparatus of claim 2 further comprising a pickup roller for transferring a coating liquid to the blanket coating roller and a metering roller for controlling the amount of coating liquid transferred to the blanket coating roller.

8. The coating apparatus of claim 7 further comprising motor means for rotating the pickup roller and the metering roller.

9. The coating apparatus of claim 7 wherein said control means is connected to said motor means for varying the speed of the pickup roller and the metering roller in response to the press speed signal.

10. Coating apparatus for a printing press including a plate cylinder and a blanket cylinder, comprising:

a coating assembly including a coating roller engaging one of the plate cylinder and the blanket cylinder, a pickup roller engaging the coating roller, and a metering roller; drive motors coupled to each of the coating roller, the pick up roller and the metering roller; and

speed sensor means coupled to a printing press and responsive to the speed of the press and coupled to the drive motors for independently controlling the rotational speeds of at least two of the coating roller, the pickup roller and the metering roller.

11. The coating apparatus of claim 10 in which the speed sensor means comprises a tachometer coupled to the press.

12. The coating apparatus of claim 11 in which the tachometer is coupled to the plate cylinder of the press.

13. The coating apparatus of claim 10 comprising individual speed controllers for each of the drive motors, so that the relative speed at the nip between any two adjacent rollers can be adjusted.

14. The coating apparatus of claim 13 further comprising means for maintaining the relative speeds of the pickup, metering and coating rollers as the press speed varies.

* * * * *

10

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 4,934,305

DATED : June 19, 1990

INVENTOR(S) : Jamie E. Koehler et al.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Title page, item [75], add "Mark A. DiRico, Quincy, MA", as an inventor, immediately after --James E. Taylor, Dallas, TX--.

Signed and Sealed this

Seventeenth Day of November, 1992

Attest:

DOUGLAS B. COMER

Attesting Officer

Acting Commissioner of Patents and Trademarks

United States Patent [19]

Koehler et al.

[11] Patent Number: 4,934,305

[45] Date of Patent: Jun. 19, 1990

[54] RETRACTABLE COATER ASSEMBLY INCLUDING A COATING BLANKET CYLINDER

[75] Inventors: Jamie E. Koehler, Montreal, Canada; James E. Taylor, Dallas, Tex.

[73] Assignee: Dahlgren International, Inc., Dallas, Tex.

[21] Appl. No.: 365,680

[22] Filed: Jun. 13, 1989

[51] Int. Cl.⁵ B05C 1/02

[52] U.S. Cl. 118/46; 101/329

[58] Field of Search 118/46, 258, 262, 259; 101/329, 137, 147

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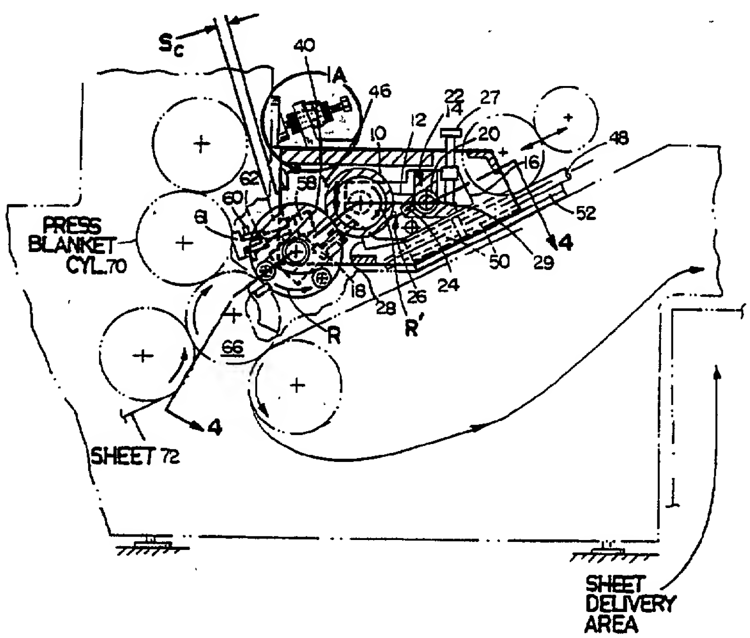
Primary Examiner—Willard Hoag

[57] ABSTRACT

An addition to a multi-color lithographic offset printing press comprising a self-contained coating unit moveable into and out of operative relationship with the last stage impression cylinder without interrupting or disrupting printing taking place in this last stage. The coating unit includes a special blanket cylinder, a transfer roller and doctor or metering means to control the amount of coating material on the transfer roller. Inclined tracks are provided to guide the coating unit into and out of operative relationship with the impression roller of the last printing stage.

17 Claims, 3 Drawing Sheets



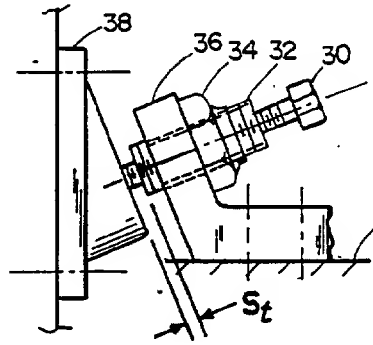

38
36
34
32
30
46
S_t

FIG. 1A

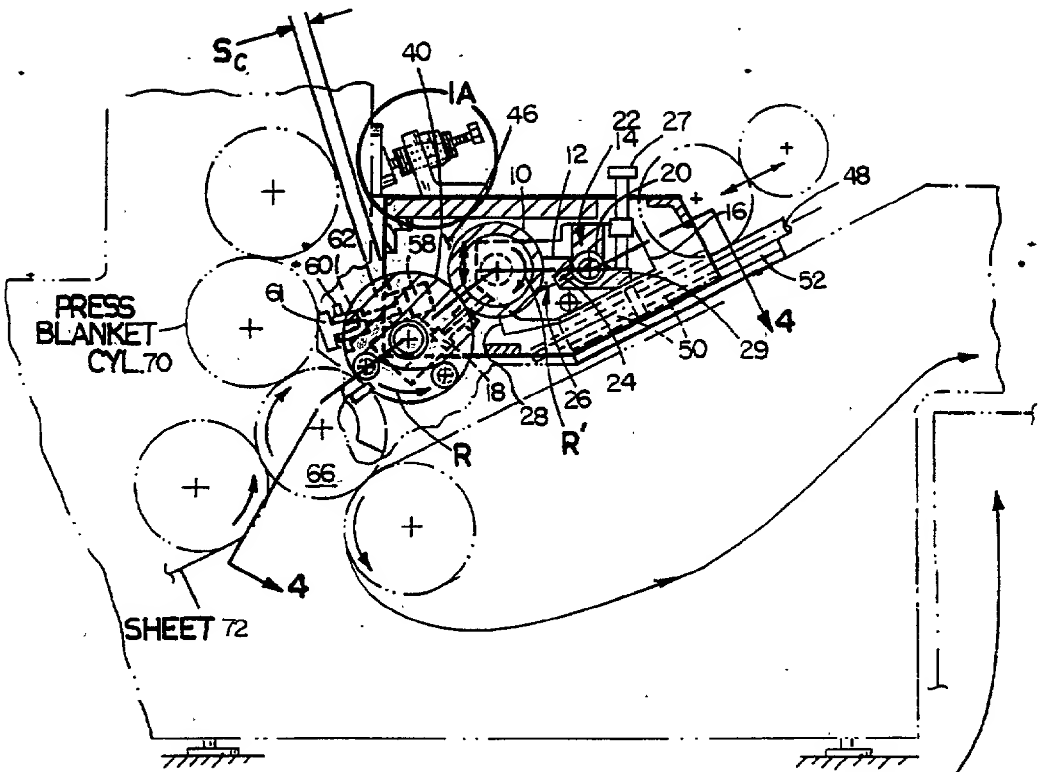

S_c
40
IA
46
22
27
14
12
10
20
16
48
62
58
60
61
PRESS BLANKET CYL. 70
52
4
50
29
24
26
18
28
R'
R
66
4
SHEET 72
SHEET DELIVERY AREA

FIG. 1

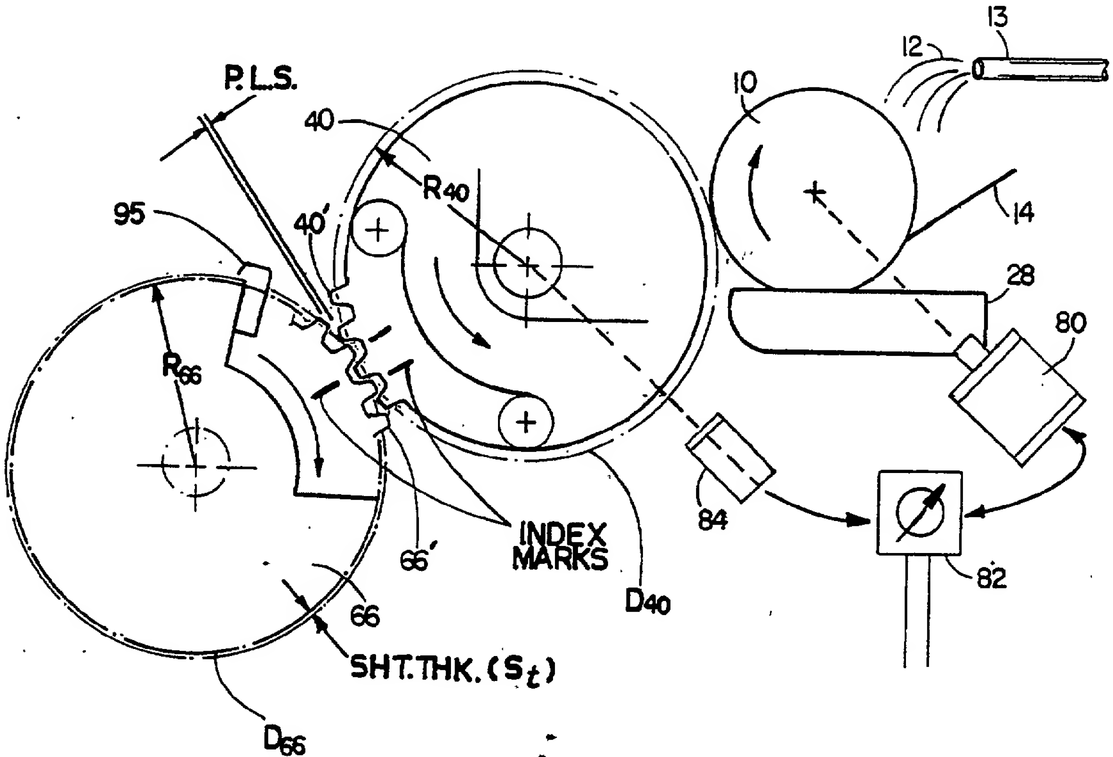

13
12
10
14
28
80
84
82
P.L.S.
40
R40
95
40'
R66
66'
INDEX MARKS
D40
66
SHT.THK. (S_t)
D66

FIG. 2

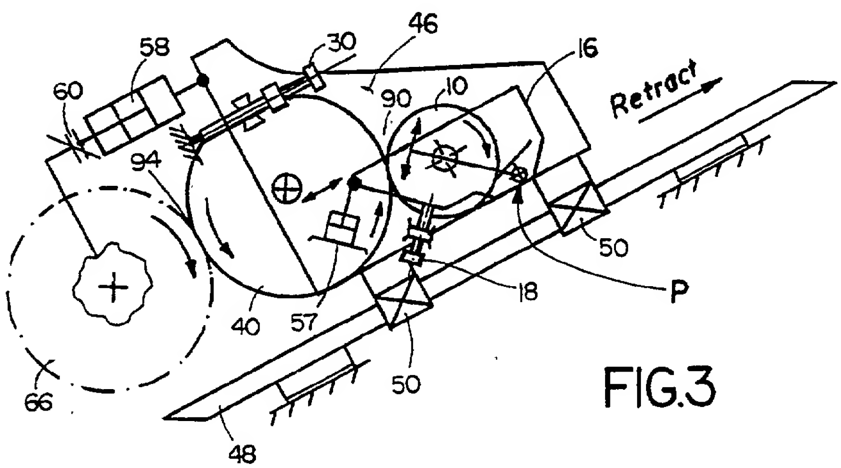

58
30
46
16
60
90
10
Retract
94
50
18
P
40
57
50
66
48

FIG.3

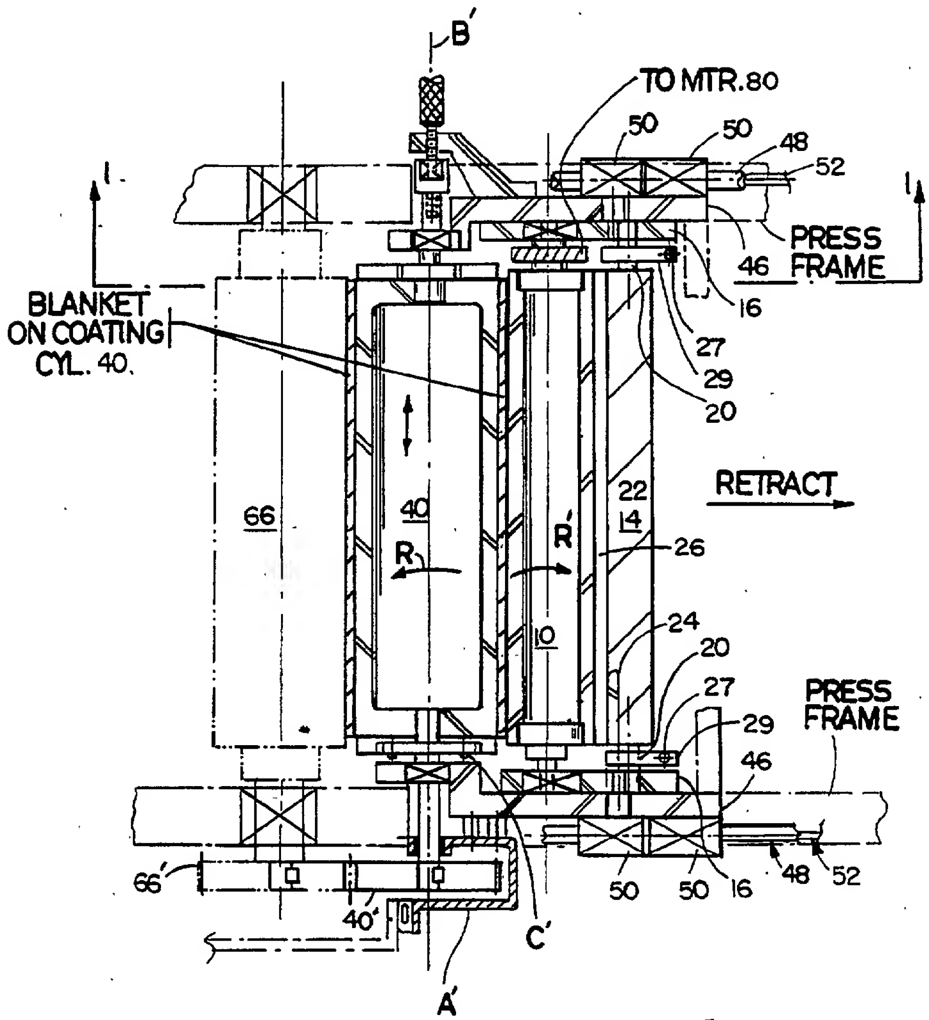

B'
TO MTR. 80
50
50
48
52
PRESS FRAME
46
16
BLANKET ON COATING CYL. 40.
27
29
20
RETRACT
22
14
66
40
R
R'
26
10
24
20
27
29
PRESS FRAME
46
66'
40'
50
50
16
48
52
C'
A'

FIG.4

RETRACTABLE COATER ASSEMBLY INCLUDING A COATING BLANKET CYLINDER

BACKGROUND OF THE INVENTION

This invention relates to coating printed sheets. It more particularly refers to a process and apparatus for coating sheets which have been printed on offset printing equipment.

In many applications it is desirable to apply a spot or overall coating to a printed sheet. For example, a UV curable or water-soluble polymer finish may be applied to a workpiece printed by offset lithography. The coating on the sheet is quickly dried while the surface of the ink is still tacky. This coating avoids the need for powder driers sprayed between sheets to present offsetting of oxidation-dried inks that are slow to dry. These coatings are also useful for providing a glossy finish that improves the rub-resistance of the workpiece and improves its overall appearance and feel. Finally, adhesive coatings may be applied to printed packaging; for example, heat-set adhesives may be applied to enable attachment of a feature such as clear plastic bubble of a package used to display the product. It is said that Ultraviolet cured and aqueous overprint coatings are, by some measurements, the fastest growing segments of the printing industry.

Application of coatings to a workpiece is made difficult by various requirements. For example, the coating should be uniform and its thickness should be controlled. Moreoever, the aqueous coating should be applied quickly, before its vehicle evaporates causing it to thicken. Finally, it is desirable for the coater to operate "in line" with the press that prints the workpiece to take full advantage of the fast drying capability of coatings and generally to simplify the manufacture of printed coated workpieces.

Butler U.S. Pat. No. 4,270,483 discloses an in line coating apparatus for attachment to a conventional offset lithographic printing press. The apparatus includes a set of rollers (i.e., pick-up roller **14** and application roller **16**) to deliver coating material from a reservoir **18** to a standard press unit blanket roll **108**. A metering rod **40** meters the amount of coating transferred to application roller **16**.

An in line coater sold by Norton Burdett Co. of Nashua, N.H. has a single roller driven directly by a D.C. motor. The roller is a gravure cylinder that transfers coating to a standard press unit blanket cylinder. The coater is attached to a pivoting arm, and the unit can be pivoted away from the press unit when the coater is not in use.

Another in line coater, sold by IVT Colordry, Inc. of Fairfield, Conn., applies coating from a reservoir pan to a standard press unit blanket cylinder using a pick-up roller that delivers a coating supply to an applicator roller; the applicator roller applies the coating to the blanket cylinder of a press unit.

Kumpf U.S. Pat. No. 3,768,438 discloses a coater in which a fountain roller dips into a coating reservoir and transfers liquid coating material to a feed roller. The feed roller in turn transfers coating material to a coating roller that coats a sheet fed between the coating roller and a format roller.

Di Rico U.S. Pat. No. 4,685,414 discloses a process and apparatus for use in combination with an existing press unit wherein the coating means is retractable, to be used or not as the printer requires. In this device, the coating means utilizes the blanket roll of the last unit of the press, and this last unit cannot be used for color application means when it is used for coating. For example in a four color press, utilizing the coating apparatus of the '414 patent would then permit only three colors to be printed in in-line, single pass operation.

Bird U.S. Pat. No. 4,796,556 discloses an offset lithographic apparatus with a plate cylinder and a blanket cylinder, and an in line coater to apply liquid coatings either in a pattern or over the entire workpiece. The apparatus has a carriage which moves the coater between a first position operative association with the plate cylinder of the lithographic press unit (see full line of unit **72** in FIG. **1**) and a second position in operative association with the blanket cylinder of the lithographic press unit (see broken line of unit **72** in FIG. **1**). In the first position the coater applies spot coating, and in the second position the coater applies coating over the entire sheet.

Satterwhite U.S. Pat No. 4,308,796 discloses apparatus for adapting an offset lithographic press to flexographic operations, the flexographic operation being either for coating or printing. Coating is achieved by applying a photosensitive plate to the lithographic blanket roll of the offset press. A transfer roll supplies coating to the plate. Inking is achieved in a like manner but with a flexographic plate having raised image areas.

Makosch U.S. Pat. No. 4,397,237 discloses a pivoting secondary inking system ("B" in FIG. 2).

Preuss et al. U.S. Pat. No. 3,391,791 discloses a sheet coater which moves into engagement with various cylinders in a press delivery area.

Knodel et al. U.S. Pat. No. 3,916,824 discloses a coating assembly which includes a fountain roll, a metering roll and an applicator roll for coating band of ribbon material. The coater is horizontally displaceable on an auxiliary frame.

Jahn U.S. Pat. Nos. 4,615,293 and 4,706,601 disclose separate duplex coating units disposed downstream of a printing press. The units permit coating of selected portions of the workpiece using a relief plate or permit blanket coating.

Switall U.S. Pat. No. 4,617,865 discloses a coater that can be pivoted into and out of position in contact with the blanket cylinder of the press unit; the coater being retractable with the same limits as that of the Di Rico device, i.e., the coating and printing functions cannot be performed simultaneously.

Jirousek U.S. Pat. No. 2,320,523 discloses a self-adjusting dampening roll.

Edwards U.S. Pat. No. 4,222,325 discloses a retractable dampening and inking unit.

Egnaczak U.S. Pat. 3,800,743 discloses a coater for a photoelectrophoretic process.

DeLigt U.S. Pat. No. 3,397,675 discloses a coating or printing station having its applicator and transfer rolls attached to pivotally mounted supporting frames.

Some commercial presses, such as Heidelberg GTO and MO include an extra blanket cylinder e.g., for numbering, printing extra colors, perforating, center slitting, etc. This added cylinder is a fixed part of the press, and does not retract with associated equipment for numbering or imprinting.

SUMMARY OF THE INVENTION

This invention generally features apparatus that operates on line with a sheet-fed lithographic printing press

unit to apply a liquid coating to a sheet workpiece. The apparatus includes a liquid coating supply means, a special coating blanket cylinder (in addition to the blanket cylinder of the press unit), and means for metering and transfering coating material operatively connected to the coating blanket cylinder and to the liquid coating supply means, for controlling the amount of coating supplied onto the coating blanket cylinder from the supply means. Structural members integrate the means for metering and transfering coating and the coating blanket cylinder into an independent, cooperatively operating, coating assembly. The apparatus also includes a means for positively driving the coating blanket cylinder in association with the press unit impression cylinder and mounts for guiding movement of the coating assembly between an operative position, in which the coating blanket cylinder is operatively engaged with the press unit impression cylinder, and an off imprint (or off-impression) position, in which the coating blanket cylinder and drive is slightly separated from the impression cylinder (i.e., separated sufficiently to prevent contact). In the operative position the coating blanket cylinder can be accurately adjusted relative to the impression cylinder. Moreover, the coating assembly can be actuated so the coating blanket cylinder is slightly separated from the impression cylinder. Such adjustment and actuation are achieved without a change in the coating blanket cylinder position relative to the coating metering and transfer means.

The system is especially adaptable to press types such as the Heidelberg Speedmaster line of presses, where there is access on the impression cylinder of the last press unit, between the press blanket cylinder and the sheet transfer cylinder of the delivery, to add a blanket cylinder for coating. The coating blanket cylinder is adapted to provide a coating surface, which preferably is the same basic diameter as the standard printing blanket cylinder. By "adapted to provide a coating surface", we mean that the coating blanket cylinder can receive a standard resilient blanket, or it can receive a relatively hard or resilient relief plate. Alternatively, the cylinder could have a surface with permanent relief. For spot-coating, the coating blanket cylinder carries a photopolymer relief plate. This cylinder is also preferably equipped for circumferential and lateral (side) register to enable accurate positioning of the plate. Pin register may also be supplied for pre-positioning of the plate relative to the positions of upstream printing plates. Pin-register may be supplied in lieu of, or, in conjunction with circumferential and side register means. The photopolymer plate may be installed in the same blanket reels or clamps as provided for the blanket, or, may be attached to the cylinder, independent of the blanket clamping provisions.

The coating blanket cylinder continuously delivers a smooth, uniform metered amount of liquid coating material to one position of a sheet workpiece carried on the press unit impression cylinder, while at the same time, printing is immediately being applied by the press unit blanket cylinder, prior to coating, to a different position of the sheet workpiece.

Preferred embodiments of the invention are characterized as follows. The mounts guide the coating assembly to move to a fully retracted position in which the assembly and particularly the coating blanket cylinder are completely disengaged from the press unit impression cylinder at a remote location from the press unit cylinders. The coating transfer means comprises a transfer (delivery) cylinder (e.g. an engraved or smooth cylinder) in operative contact with the coating blanket cylinder, as well as a metering means (an elongated blade or a metering roll) for metering the amount of coating carried on the transfer cylinder. The coating assembly is mounted on an inclined support attached to the press frames of the delivery section of the press. Coating is circulated by recirculation means. Coating is supplied between the transfer means and the metering means, flows longitudinally along the length of the transfer and metering means and cascades at the ends thereof to a drip pan positioned below the metering means. A drip pan outlet is in operative association with the recirculation means, and the coating supply means communicates with the recirculation means, to supply recirculated coating to the transfer and metering means. The coating blanket mounted on the blanket cylinder and the press unit impression cylinder have substantially the same effective operating diameter. The apparatus includes means to control pressure or width of the nip between the transfer cylinder and the coating blanket cylinder. The apparatus also includes means to control the actuation, adjustment and speed of the transfer cylinder relative to the blanket cylinder. A gear is adapted to positively, drivingly, couple the coating blanket cylinder to the impression cylinder when the assembly is in the first (operating) position. The apparatus also includes means for adjusting the coating blanket cylinder relative to the press unit impression cylinder while the two cylinders remain drivingly engaged. An adjustable stop controls the nip between the coating blanket cylinder and the impression cylinder, without changing the relationship between the coating blanket cylinder and the liquid coating metering and transfer means. The coating blanket cylinder can be lightweight (aluminum) with means enabling lateral and/or circumferential register adjustment relative to the adjacent press impression cylinder.

This invention thus provides a direct coating system for a sheet fed printing press, preferably a multi-color press, and enables in line printing and coating at the same time on a single press unit, thus maintaining the printing capability of the printing press unit. When a press unit (preferably the final press unit) is retrofitted with the retractable coating assembly of this invention, an existing impression cylinder in the press unit acts as a common impression cylinder, so that ink is first applied to a sheet being fed on the impression cylinder and a coating is applied directly to the sheet over the last ink application. After this dual sequential application of ink and coating onto a sheet on the same impression cylinder, the coating can be suitably dried by air, infra red heat, ultra violet radiation or any other means adapted to quickly dry the coating.

This apparatus is capable of delivering a metered amount of coating through a special blanket roll to a sheet carried by the last impression cylinder in a printing press substantially without interrupting or changing the printing process. It allows spot coating or overall coating as may be desired by the printer. It operates without the use of bulky complex metering systems, yet the apparatus is versatile in that the printer can bring the coater in line or not, as he desires, without changing or interfering with an existing printing operation. Adjustment of the coating blanket cylinder and entire assembly is made relative to the impression cylinder to compensate for various sheet thicknesses to be printed. The assembly is furthermore actuatable while still drivingly

engageable with the impression cylinder, to on off positioning of the cylinder when operating in the first position.

The entire apparatus is further retractable to the second position by a simple retraction device, such as a linear-actuator, winch, hydraulic cylinder or the like (not shown), up an inclined plane (the same plane as for movement for adjustment and actuation), to provide access to: (1) the coating blanket cylinder for changing blankets, packing, clean up, maintenance, etc.; (2) the standard printing blanket cylinder; (3) the impression cylinder; and (4) the sheet delivery area, beneath the coating apparatus, housing the conventional Infra red or UV drying unit. In this second retractable position, the apparatus may be used as a seat by the operator, as desired, for standard printing press unit operation.

A gear cover is provided about the blanket cylinder gear and is designed to resiliently sealingly engage the gear cover of the printing unit to which the coating apparatus is installed. When the coating unit is retracted, a cover is supplied to seal the cutout in the press gear cover. Therefore the integrity of the oil bath is maintained within the press gear cover in both operating and retracted positions of the apparatus.

A specific sequence of actuation of the transfer roll relative to the coating blanket cylinder, and actuation of the coating blanket cylinder (and, therefore, of the entire assembly) relative to the impression cylinder for proper coating operation, is specifically discussed later herein. This apparatus is well adapted to be built into a new printing press or to be retrofited into existing equipment.

Other feathers and advantages of the invention will be apparent from the following description of the preferred embodiment.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side view of the coating apparatus including a diagrammatic view of a printing press with which it is operatively associated. In this FIG. the cylinders of the coating assembly are shown in solid in their coating operating position and in phantom in their retracted position. The coating apparatus is shown in section.

FIG. 1A is a side view of stop on the coating apparatus of FIG. 1.

FIG. 2 is a diagrammatic side view of a set of coating application rollers showing details of controls for positively, drivingly, linking these rollers to a printing system; and

FIG. 3 is similar to FIG. 2 showing a schematic view of controls for the coating apparatus hereof for adjustment, actuation and retraction of the coating assembly relative to the press, actuation and adjustment of the transfer roll relative to the coating blanket cylinder and the metering means relative to the transfer roll.

FIG. 4 is a cross-sectional view taken along lines 4—4 from FIG. 1.

SPECIFIC EMBODIMENTS OF THE INVENTION

This invention will be described with reference to the drawing in which like parts have been given like reference characters.

Referring now to FIGS. 1 and 4, the coating apparatus assembly of this invention comprises a transfer roller 10, journalled for rotation, onto which is fed coating material 12, and a metering assembly 14 which is suitably adjustably mounted relative to the transfer roll to deliver a predetermined quantity of liquid coating, substantially evenly along the surface of the transfer roller 10. This metering assembly 14 includes a rotatably mounted journal 20 which is generally parallel to the axis of the metering roller 10. Mounted substantially centrally about the journal 20 is a housing 22 from which a blade clamp 24 extends. A doctor blade 26 is positioned in the blade clamp 24 and is angularly positioned against the metering roller 10. The doctor blade 26 is suitably made of blue spring steel, suitably about ten thousandths of an inch thick, and suitably extends out of the clamp 24 about one-half inch. The angular position of the blade 26 may be about 40° to a tangent to the transfer roller surface. It has been found to be useful to force the doctor blade 26 against the transfer roller 10 with a pressure of about one-half to one pound per linear inch. The transfer roll (with the metering device) is mounted at each end thereof in a common frame 16 which is in turn rotatably supported in a coater assembly housing 46. Frame 16 is pivotally rotated, or otherwise moved, by cylinder 57, not shown, to adjustably engage transfer roll 10 to a lightweight (e.g, aluminum) coating blanket cylinder 40 for proper coating application. Movement of frame 16 does not affect pressure between roller 10 and blade 26. Likewise, movement of housing 46 does not affect the pressure setting, or the relative positions, of transfer roll 10 and coating blanket cylinder 40. Adjustable stop 18 is provided to set a light "kiss" pressure between roller 10 and cylinder 40.

A drip pan 28 having an outlet is provided, and is positioned below the transfer roller 10 and the metering assembly 14. The pressure exerted by the doctor blade 26 against the metering roller 10 can be adjusted by means of two adjustment screws 27 which extend to corresponding adjustment brackets 29 clamped on the axle 20. It is preferred that the adjustment screws are attached to the brackets off center with respect to the axis of the axle 20 so that the rotation of these adjustment screws will pivot the axle 20 whereby changing the pressure of the doctor blade 26 on the roller 10. A cover may be provided over the coating 12 and roller 10.

A coating blanket cylinder 40 is provided in operative, takeoff contact with the transfer roller 10. The blanket roller has its own journals rotatably mounted, suitably in needle bearings, and supportingly attached to the same housing 46 as supports the common frame 16 for the transfer roller and metering assembly. This housing 46 is slidably mounted on rails 48 which, in a preferred embodiment of this invention, are inclined so as to easily move the coating assembly into and out of the line as well as provide a guide for adjustment and actuation of the coating blanket cylinder (and entire unit) relative to the impression cylinder of the press.

Specifically, the housing 46 is mounted on bearing blocks 50 that are in turn slidably mounted on the two parallel rails 48. The rails 48 are mounted on rail supports 52 which are adapted to be directly connected to the press unit.

Hydraulic cylinders 58 each with an adjustable clevis 62 are mounted on opposite sides of the housing 46 to provide proper actuation and a "kiss" pressure contact between the coating blanket on the special blanket cylinder 40 and the sheet on press impression cylinder 66. Suitably a latch 60 is provided to insure positive positioning and lock up of the entire coating assembly with relation to the printing unit, i.e., the coating blanket cylinder 40 with the impression roller 66.

Double adjusting screws 30 and 32 are supported by support 36 attached to housing 46. Screw 30 bears against stop block 38, attached to the press frame. Screw 32 is locked by nut 34. Rotation of screw 30 provides for paper pressure adjustment and thickness changes in sheet stock, while setting screw 32 provides a safety such that gears mounted on the coating blanket cylinder and press impression cylinder, cannot be meshed beyond a preset point while in the coating mode of operation. Once nut 34 is tightened, the nut is fixed (as if it were welded or pinned) for a specific screw 32 setting. Clearance "S_c" in FIG. 1 depends on the thickness of the sheet, S_t which is generally between 0.000 to 0.030 inches. As shown in FIG. 1, clevis 62 is adjusted such that a clearance exists within cylinder 58, between the piston and cylinder wall. The piston serves as an "OFF" stop for the coating assembly when the assembly is actuated. A separation will therefore exist between the blanket and sheet when in the "OFF" impression position. For a theoretical 0.000 sheet thickness, S_c should be set for 0.060 inches approximately.

A gear-motor 80, which may be hydraulic or electric, is suitably provided to drive the transfer roll 10. Suitable motorized means is provided to retract the coating assembly into and out of operative relation with the impression roller 66, up and down the rails 48.

The coating assembly is shown in cooperative relationship with a conventional series of printing rollers. The coating blanket on blanket cylinder 40 is in light "kiss" contact with the sheet on impression cylinder 66, the sheet on the impression cylinder being also in contact with a printing blanket on blanket cylinder 70; impression cylinder 66 thereby serves as a dual impression cylinder, first for printing and next for coating. The sheet work piece is shown at 72.

The coater is first locked into operation on the press unit by lowering it along the rails 48 toward the press unit and engaging clevis 62 to lug 61 mounted on the press through releasable latch pin 60. In operation, gear-motor 80 mounted on housing 46 rotates the roller 10 as coating fluid is pumped under pressure from a fluid reservoir (not shown) to an inlet opening in the doctor blade assembly. From there, coating spreads over the surface of roller 10 and is distributed by the doctor blade 26. A continuous flow of coating is maintained over the surface of the roller 10 and excess coating is recovered through a drip pan 28, with an outlet for recycling. In this way, sufficient flow is maintained to provide a flooded nip of coating between roller 10 and blade 26 and to provide uniformity of coating along the rollers' length. The amount of coating carried by the metering roller 10 can be adjusted somewhat by turning screws 27 to adjust the pressure between doctor blade 26 (or a metering roller) and the transfer roller 10, as described above. Hydraulic cylinders 58 serve to pull the entire unit against the press with a force that can be adjusted by adjusting the pressure in the cylinders 58. Screw 30 adjusts "ON" pressure between the coating blanket on blanket cylinder 40 and a sheet carried on impression cylinder 66. Cylinders 58 further serve to separate the coating blanket cylinder from the impression cylinder while gears mounted on the adjacent cylinders still remain in mesh. Separation or clearance "S_c" in FIG. 1 is about 0.060 to 0.030 inches to provide an "OFF" condition of the coater assembly to stop application of coating. As the blanket cylinder 40 rotates in direction R, coating is applied to the just printed sheet. Transfer roller 10 rotates as shown by direction R'.

A uniform amount of liquid coating is continuously transferred to the blanket roller 40 at the nip between the blanket roller 40 and the transfer roller 10. The blanket roller 40 in turn delivers that coating to the workpiece as the workpiece travels through the nip between the blanket roller 40 and the impression roller 66. Changing the speed of roller 10 results in a change of coat weight added to the sheet.

When the coater is not in use, latch pin 60 is released, and a motorized drive moves the coating unit back along the rails 48 away from the printing rollers.

More specifically, when using an acrylic water based coating, a suitable transfer roller may be a quadrangular cell cylinder, having about 140 lines/inch, each square inch of cells carry 15 cubic billion microns of coating. A suitably engraved roller is sold by Pararco Roller Co. of Dallas, Tex. (Exact roll cell nomenclature is: 140 Rotoflo/138 for an optimum roll surface structure.) An acrylic water-based coating having about 45% solids can be applied to achieve an optimum dry coat weight of $\approx$0.4–0.6 pounds per 1000 square feet, using a roll speed of 1:1 with that of coating blanket roll 40.

Referring now to FIG. 2, there is shown a portion of a coating apparatus assembly including transfer roller 10, coating material 12 fed from a supply thereof 13 and metered onto the roller by means of a doctor blade assembly 14, including a drip pan 28. The transfer roller 10 is suitably driven by direct drive gear motor 80 whose speed is controlled by a controller 82 responding to sensor 84 which senses the speed of the coating blanket cylinder 40. Controller 82 is adjusted to provide a preset surface speed ratio, 1:1 or less, between roller 10 and cylinder 40, the slowest surface being that of roller 10. Impression cylinder 66 includes a sheet gripper 95. The coating blanket on blanket cylinder 40, and associated drive gear 40', preferably have the same operative diameter as the impression cylinder 66 and press gear 66'. Gear 40' is directly driven by press gear 66' of cylinder 66 so as to insure a positive drive relation there between. In FIG. 2, no worksheet is shown in this figure for clarity. Index marks are placed on adjacent gears to insure proper register of adjacent cylinders. The gear pitch line separation "P.L.S." is approximately equal to the sheet thickness "Sht.Thk.", S_t, shown on cylinder 66. D_{40} is a broken line corresponding to the outer diameter of the blanket on cylinder 40, and the pitch line of gear 40' and D_{66} is a broken line corresponding to the outer diameter of impression cylinder 66 and the pitch line of gear 66'. R_{40} is equal to R_{66} and thus D_{40} and D_{66} are equal.

Referring now to FIG. 3 which is similar to FIG. 2, there is shown the same three rollers, the transfer roller 10, the coating blanket cylinder 40 and the dual, common, impression roller 66. The transfer roller 10 and the coating blanket roll 40 are shown commonly mounted in assembly 46 via bearing blocks 50, on inclined rails 48. There is shown in this figure a first cylinder 57 with stop 18 which adjusts the pressure in the nip 90 between the transfer roller 10 and the coating blanket on blanket cylinder 40. A second cylinder 58 and screw 30 are provided to control the spacing in the nip 94 between the coating blanket on the blanket cylinder 40 and the dual impression cylinder 66 to accomodate a particular sheet thickness. The last color printing blanket roll 70 is not shown for clarity. Frame 16 pivots at P in FIG. 3.

FIG. 4 is a sectional view taken along lines 4—4 of FIG. 1 showing relationship or roll lengths to each other, a cover A' about the coating blanket cylinder

drive gear, lateral and circumferential register provisions for the coating blanket cylinder, B' and C' respectively and other component parts shown in FIG. 1.

As best shown in FIG. 4, housing 46 is offset to the inside of the press frame in the area of the bearings for coating cylinder 40, and therefore clears the press frame in this area. The remainder of the housing may lie along the inclined surface of the frame; that is, directly above the frame. This offsetting of housing 46 prevents having to alter (cut away) a portion of the press frame adjacent the bearing.

For sequencing of rolls for proper coating operation, the following procedure is followed:

"ON" 1. Transfer roll actuates to coating blanket cylinder upon actuation of press blanket cylinder of last printing unit.

2. Coating blanket cylinder actuates to sheet on press impression cylinder upon one full revolution of press.

"OFF" 1. Transfer roll separates from coating blanket cylinder upon actuation of blanket cylinder of preceeding press unit.

2. Coating blanket cylinder separates from the sheet on the press impression cylinder upon actuation of the press blanket cylinder of the last printing unit.

OTHER EMBODIMENTS

Other embodiments are within the following claims. For example, other doctor blade arrangements may be used to doctor the coating from the transfer roller 10, such as a system utilizing a reverse angle blade or having dual blades and having a coating inlet between the two blades. A roll, or roller means, may also replace the doctor blade arrangement. Other types of engraved or smooth surfaced cylinders may be used. Other types of presses may be used in conjunction with the coater, but offset lithographic sheet feeding presses are preferred.

I claim:

1. An apparatus for applying a liquid coating to a sheet workpiece, said apparatus being adapted for operation on line with a unit of a sheet-fed lithographic printing press, said press unit comprising a press unit blanket on a press unit blanket cylinder engageable at a first printing location on a sheet workpiece on a press unit impression cylinder; said apparatus comprising:

a liquid coating supply means;

a coating blanket cylinder adapted to provide a coating surface;

a means for metering and transferring liquid coating material operatively connected to said coating surface on said coating blanket cylinder and to said liquid coating supply means, for applying a controlled amount of coating on said coating surface of said coating blanket cylinder;

structural members integrating said means for metering and transferring coating material and said coating blanket cylinder into an independent, cooperatively operating, coating assembly;

means for positively driving said coating blanket cylinder in association with said press unit impression cylinder; and

mounts for guiding movement of said coating assembly between an operative position in which said coating surface on said coating blanket cylinder is operatively engaged with a second location on said sheet on said press unit impression cylinder and an off imprint position in which said coating surface on said coating blanket cylinder is slightly separated from said sheet workpiece on said press unit impression cylinder, said coating assembly including said means for metering and transferring coating material, remaining intact during movement of said coating assembly;

whereby in said operative position, said coating surface continuously delivers a smooth, uniform, metered amount of said liquid coating material to said sheet workpiece on said impression cylinder at said second location on said impression cylinder while printing is being applied by said press unit blanket to said sheet workpiece at said first location on said impression cylinder.

2. The apparatus of claim 1 wherein said means for metering and transferring coating comprises a transfer cylinder in operative contact with said coating surface on said coating blanket cylinder and means for metering the amount of coating carried on said transfer cylinder.

3. The apparatus claimed in claim 2 wherein said means for metering is a doctor means comprising an elongated blade edge positioned against said transfer cylinder.

4. The apparatus claimed in claim 1 wherein said coating assembly is mounted on an inclined support.

5. The apparatus claimed in claim 1 further including a drip pan positioned below said metering and transferring means comprising an outlet, and recirculation means in operative association with said outlet, said liquid coating supply means communicating with said recirculation means to deliver recirculated liquid coating material to said means for metering and transfering.

6. The apparatus claimed in claim 1 wherein said coating surface on said coating blanket cylinder and said impression cylinder have substantially the same effective operating diameter.

7. The apparatus claimed in claim 2 including means to control the nip betwen said transfer cylinder and said coating surface on said coating blanket cylinder.

8. The apparatus claimed in claim 1 including a gear adapted to positively couple said coating blanket cylinder to said impression cylinder when said coating assembly is in said first operating position.

9. The apparatus of claim 1 further comprising means for adjusting the coating blanket cylinder relative to the impression cylinder, while the coating blanket cylinder remains drivingly engaged with the impression cylinder.

10. The apparatus of claim 9 comprising an adjustable stop to control the nip between the coating surface on said coating blanket cylinder and the workpiece sheet on said impression cylinder, without changing the coating blanket cylinder relationship to the liquid coating metering and transfer means.

11. The apparatus of claim 1 wherein the coating blanket cylinder is a lightweight cylinder.

12. The apparatus of claim 1 wherein said coating blanket cylinder further comprises means for circumferential register with the adjacent press impression cylinder.

13. Apparatus of claim 12 wherein the coating blanket cylinder further has means enabling lateral register adjustment relative to the adjacent press impression cylinder.

14. Apparatus according to claim 13 wherein said coating blanket cylinder is adapted to receive a photopolymer plate and wherein said means for metering and transfering coating comprises a transfer cylinder, the surface of which is a transfer surface, said transfer sur-

face and the surface of said photopolymer plate being adapted for rotation together in nip contact at substantially the same surface speeds for precision spot coating to said sheet workpiece.

15. Apparatus according to claim **1** wherein said mounts guide said coating assembly to move to a fully-retracted position in which said coating assembly and coating blanket cylinder are completely disengaged from said press unit impression cylinder at a remote location from the press unit cylinders.

16. Apparatus according to claim **1** wherein said blanket cylinder is adapted to receive a blanket for coating said sheet workpiece.

17. Apparatus according to claim **1** wherein said blanket cylinder is adapted to provide a coating plate at its surface.

* * * * *

11

US005178678A

United States Patent [19]

Koehler et al.

[11] **Patent Number: 5,178,678**

[45] **Date of Patent: Jan. 12, 1993**

[54] **RETRACTABLE COATER ASSEMBLY INCLUDING A COATING BLANKET CYLINDER**

[75] Inventors: **Jamie E. Koehler**, Montreal, Canada; **James E. Taylor**, Dallas, Tex., **Mark A. DiRico**, Quincy, Mass.

[73] Assignee: **Dahlgren International, Inc.**, Carrollton, Tex.

[21] Appl. No.: **544,996**

[22] Filed: **Jun. 27, 1990**

Related U.S. Application Data

[63] Continuation-in-part of PCT/US90/03338, filed Jun. 13, 1990, which is a continuation-in-part of Ser. No. 365,680, Jun. 13, 1989, Pat. No. 4,934,305.

[51] **Int. Cl.**[5] **B05C 1/08**; B05C 1/02

[52] **U.S. Cl.** **118/46**; 101/177; 101/178; 118/211; 118/224; 118/262; 427/407.1; 427/558

[58] **Field of Search** 101/177, 178, 147, 146; 118/46, 211, 262, 224, 249; 427/54.1, 407.1

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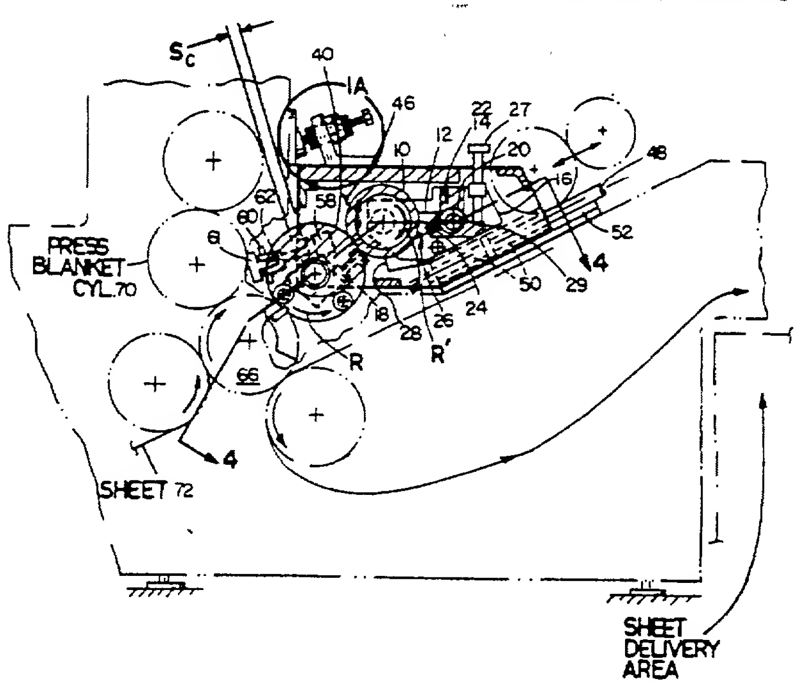
Primary Examiner—Willard Hoag

[57] **ABSTRACT**

An addition to a multi-color lithographic offset printing press comprising a self-contained coating unit moveable into and out of operative relationship with an impression cylinder on the press unit (e.g. the impression cylinder of the last press unit) without interrupting or disrupting printing taking place in this last stage. The coating unit includes a special blanket cylinder, a transfer cylinder and doctor or metering means to control the amount of coating material on the transfer cylinder. Inclined tracks are provided to guide the coating unit into and out of operative relationship with the impression cylinder of the last printing stage.

49 Claims, 10 Drawing Sheets



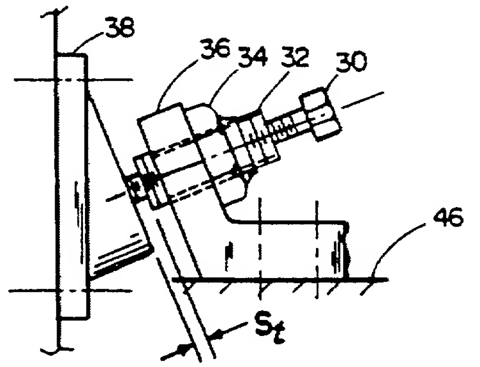

38
36
34
32
30
46
S_t

FIG. 1A

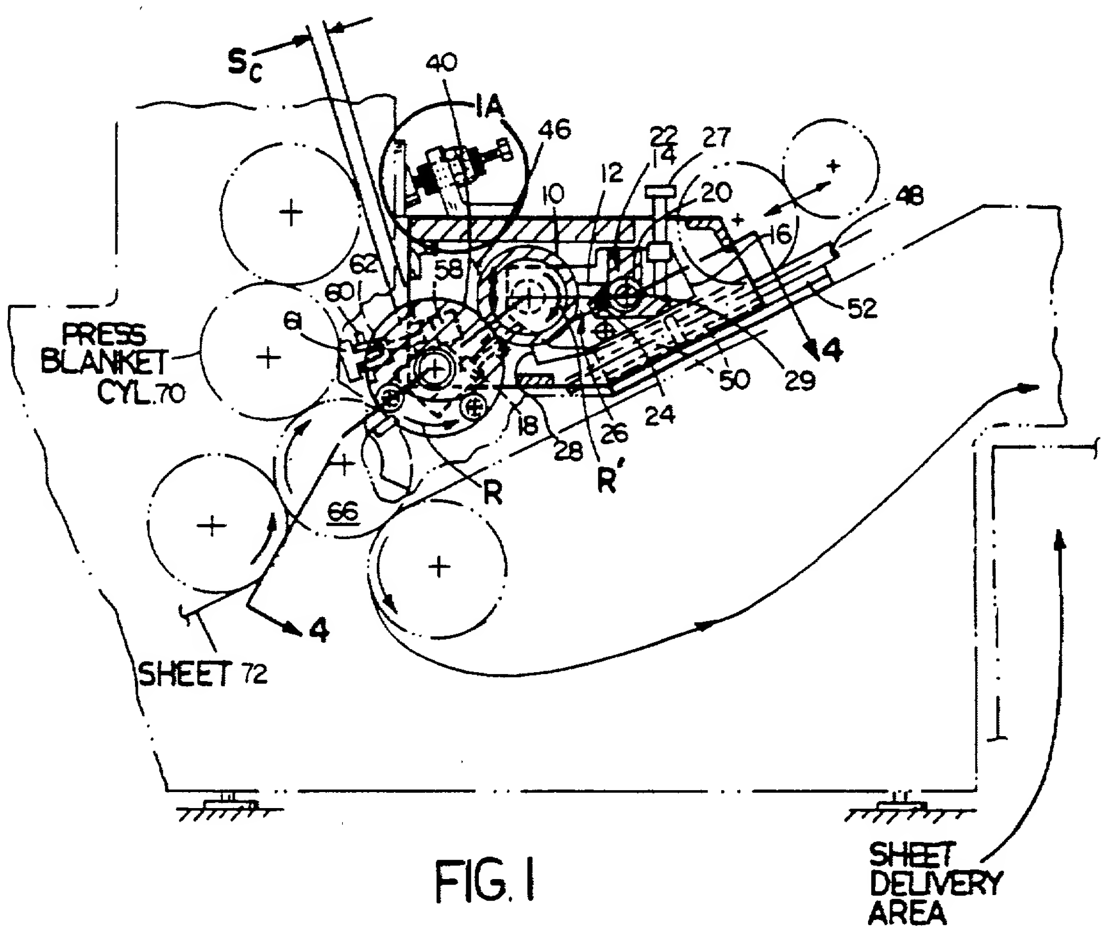

S_c
40
IA
46
22
27
14
12
10
20
48
16
62
58
60
61
PRESS BLANKET CYL. 70
52
4
50
29
24
26
18
28
R
R'
66
4
SHEET 72
SHEET DELIVERY AREA

FIG. 1

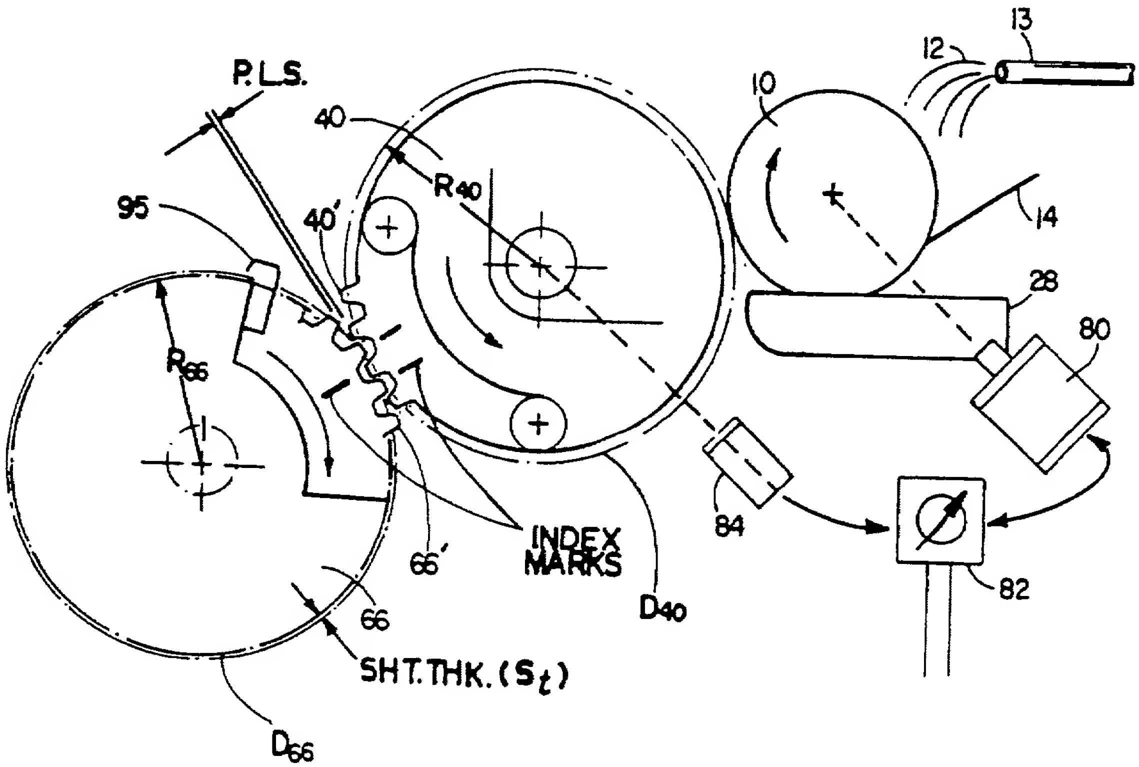

P.L.S.
13
12
10
40
R40
14
95
40'
28
80
R66
84
INDEX
MARKS
66'
82
66
D40
SHT.THK. (St)
D66

FIG. 2

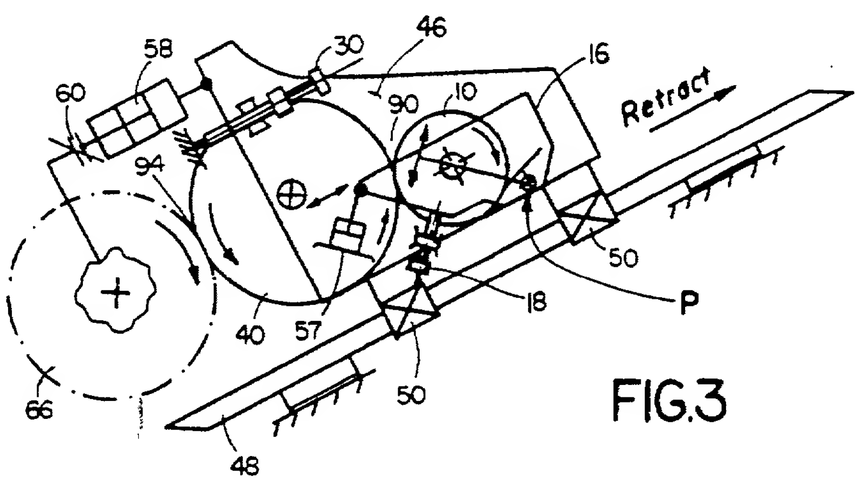

58
30
46
16
60
90
10
Retract
94
50
P
18
40
57
66
50
48

FIG.3

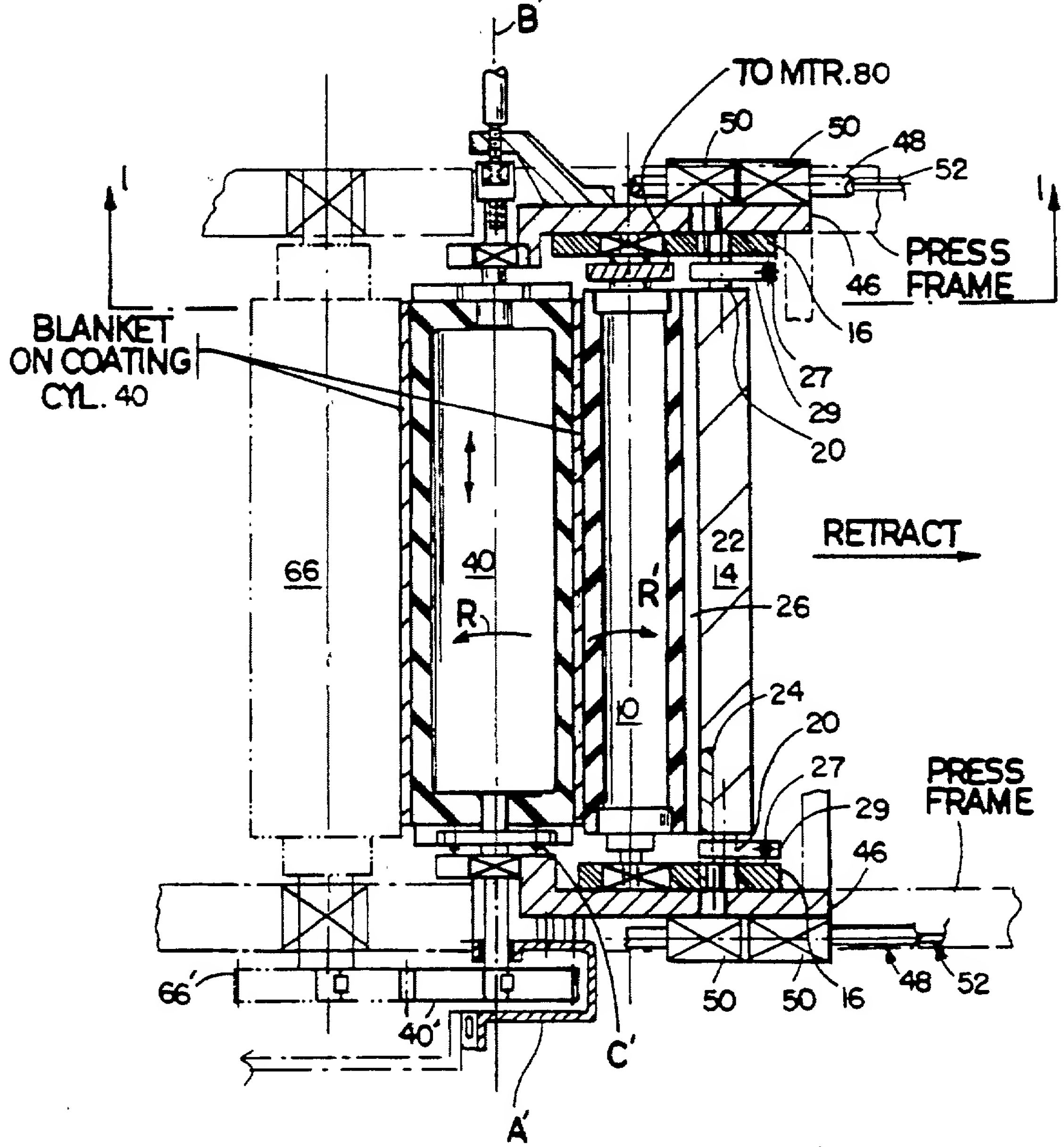
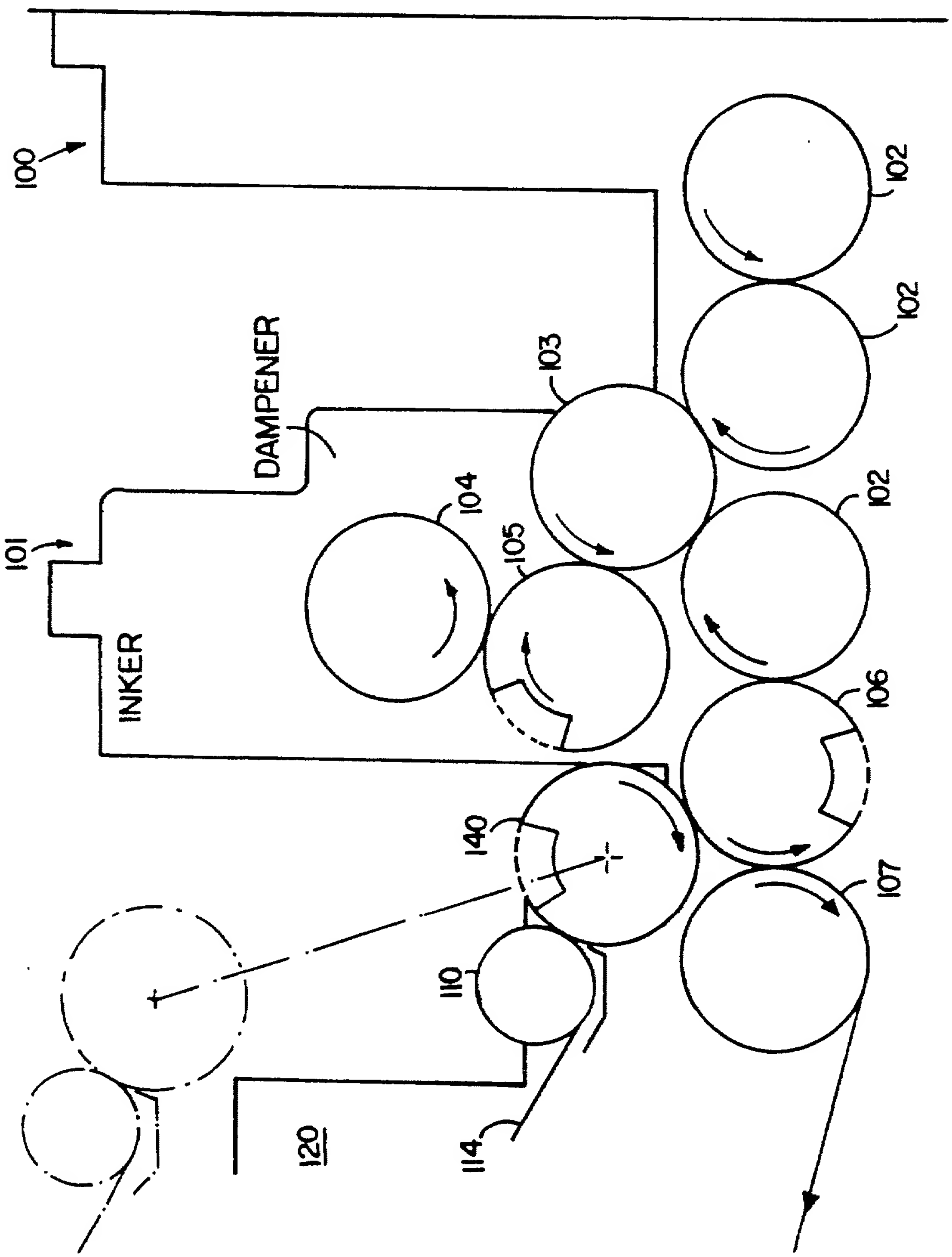

B'
TO MTR.80
50
50
48
52
I
I
PRESS
FRAME
46
16
27
29
20
BLANKET
ON COATING
CYL. 40
RETRACT
66
40
R
R'
22
14
26
10
24
20
27
29
PRESS
FRAME
46
66'
40'
50
50
16
48
52
C'
A'

FIG.4

FIG.5


100
101
102
102
102
103
104
105
106
107
110
114
120
140
DAMPENER
INKER

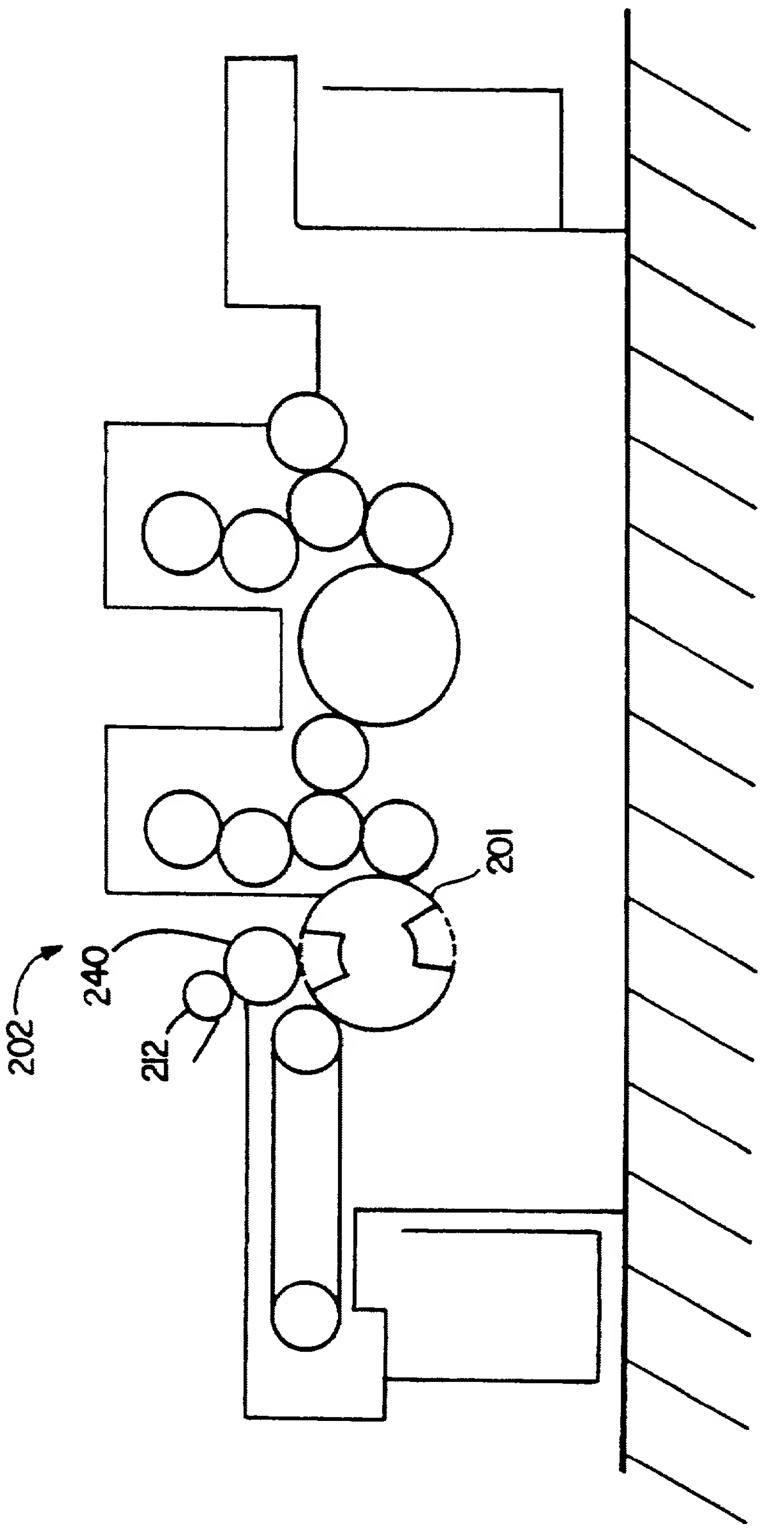


FIG.6

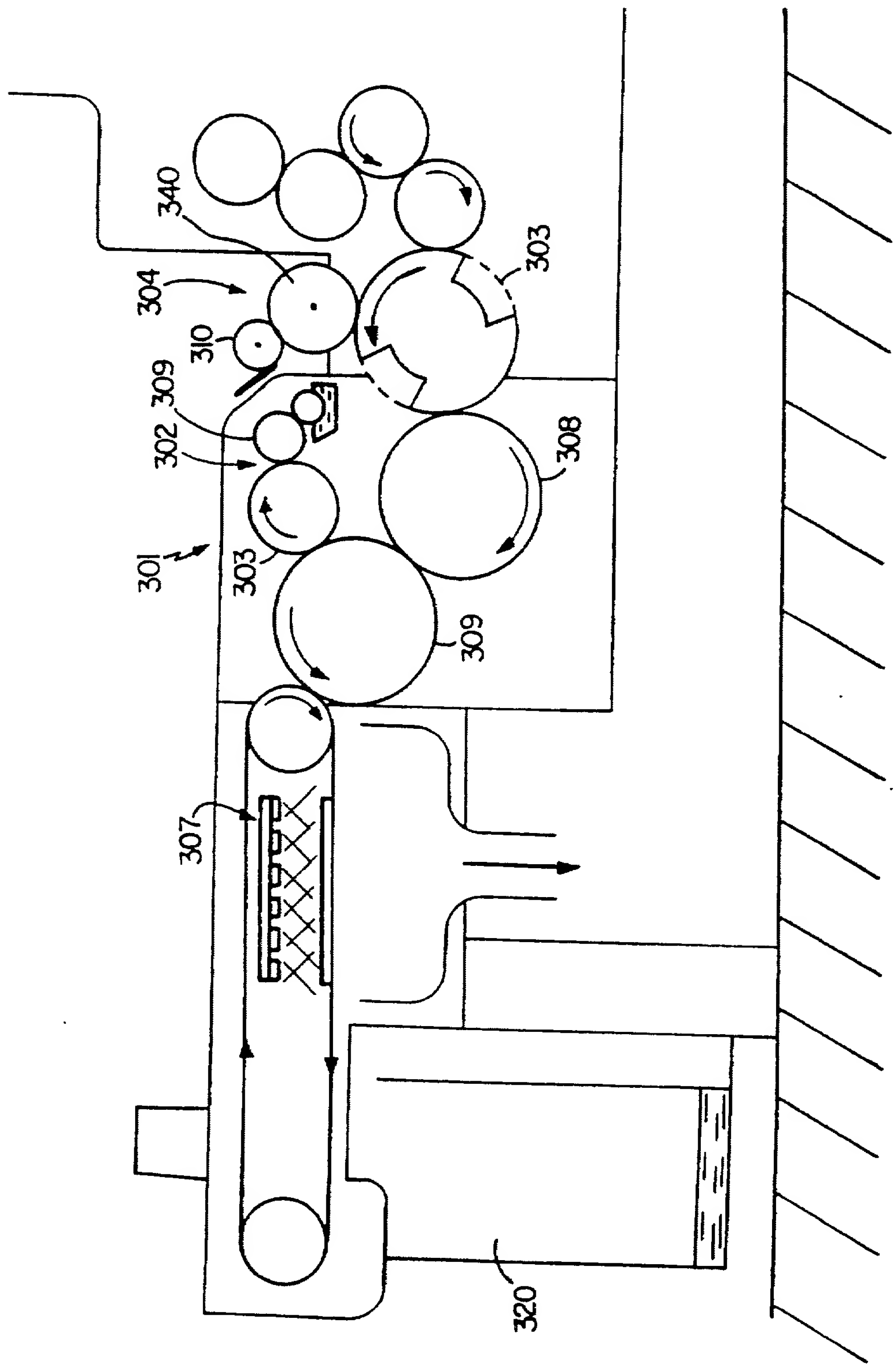


FIG.7

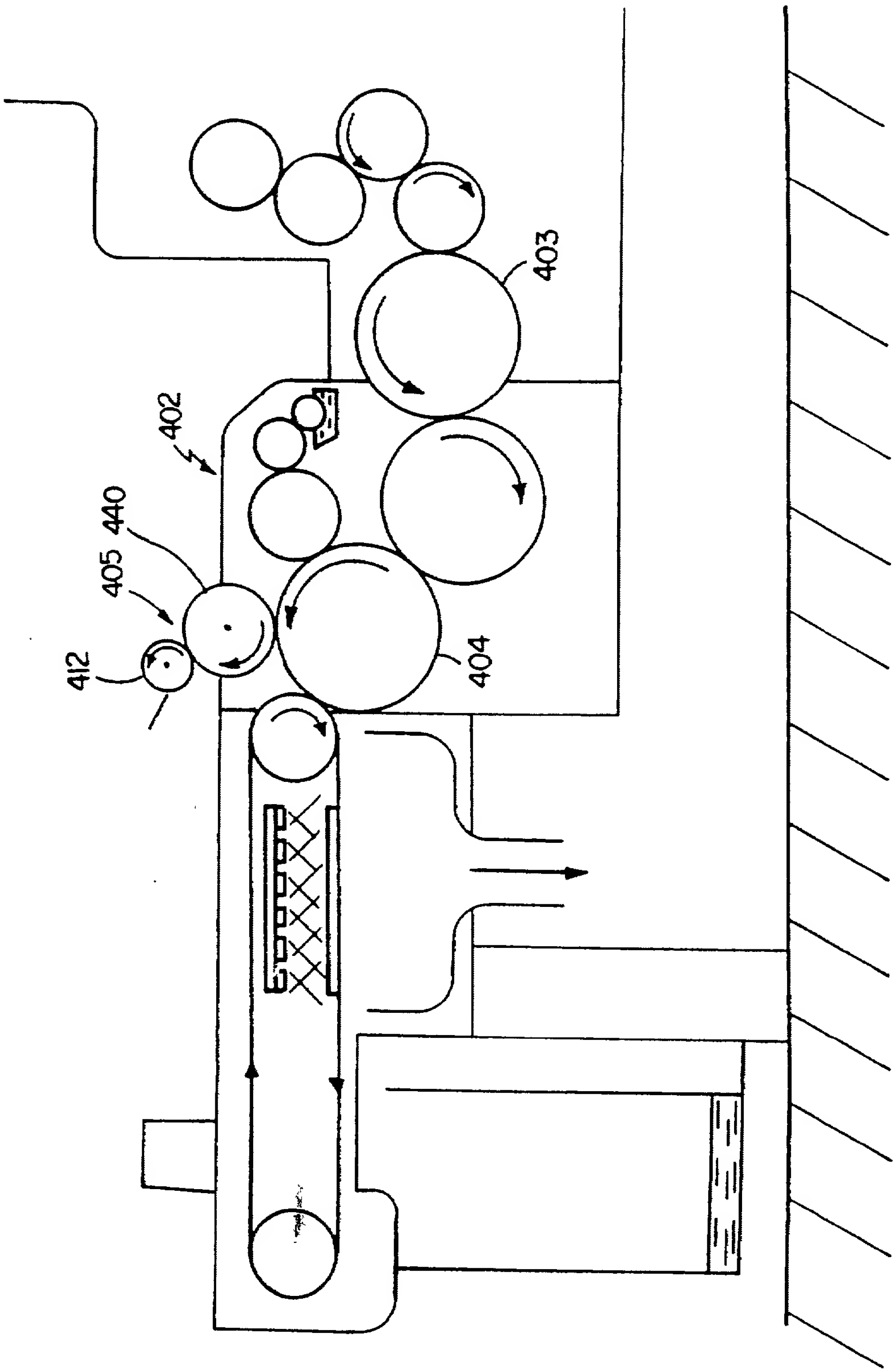


FIG.8

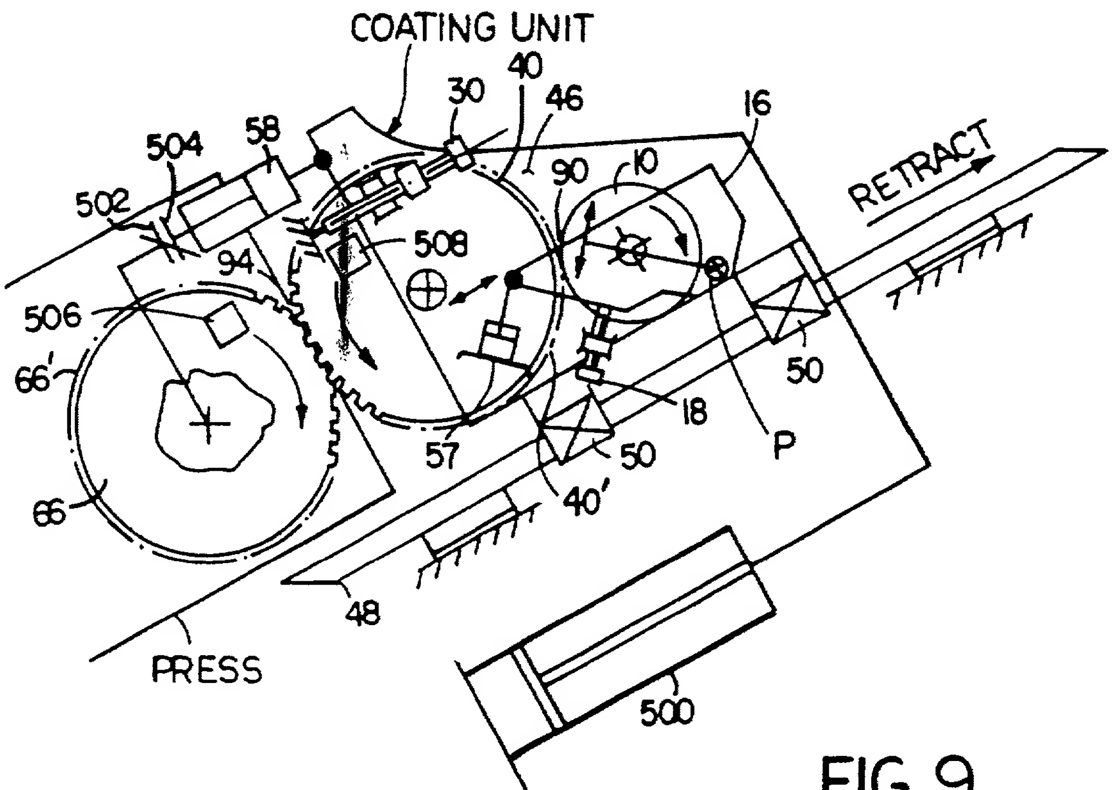

COATING UNIT
40
30
46
16
504
58
10
90
502
RETRACT
94
508
506
66'
50
18
57
50
P
66
40'
48
PRESS
500

FIG. 9

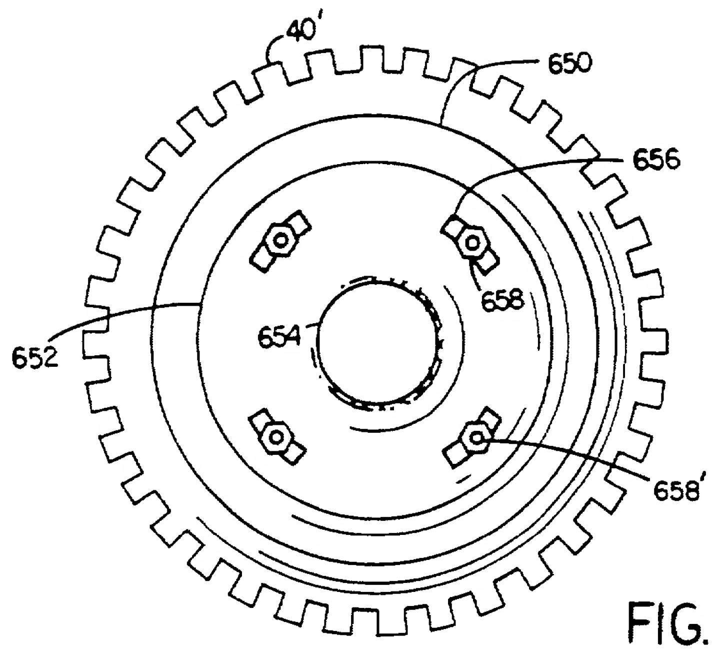

40'
650
656
658
654
652
658'

FIG. 10

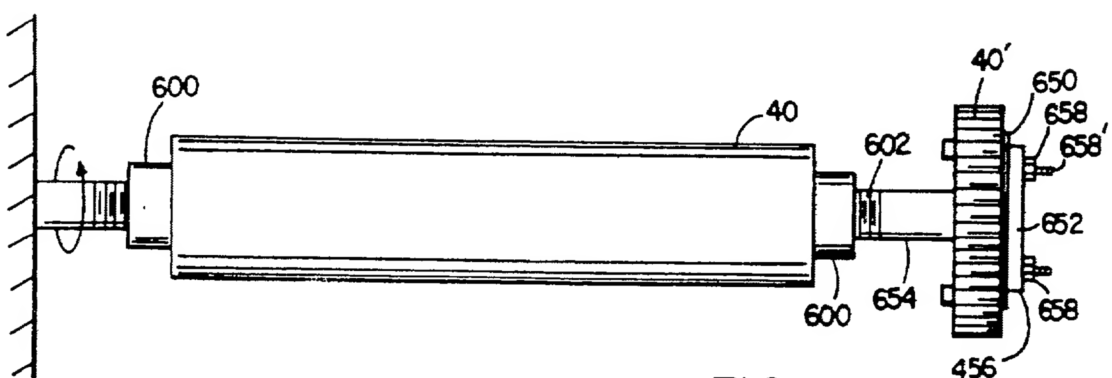

600
40
40'
650
658
658'
602
652
600
654
658
456

FIG. 11

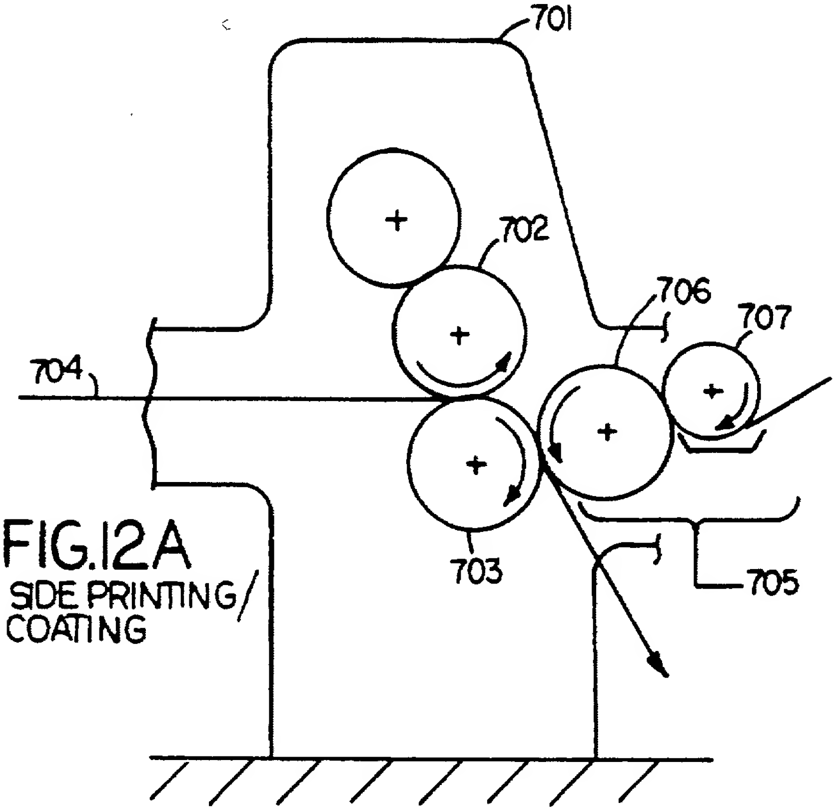


FIG. 12A
ONE SIDE PRINTING/
TOP COATING

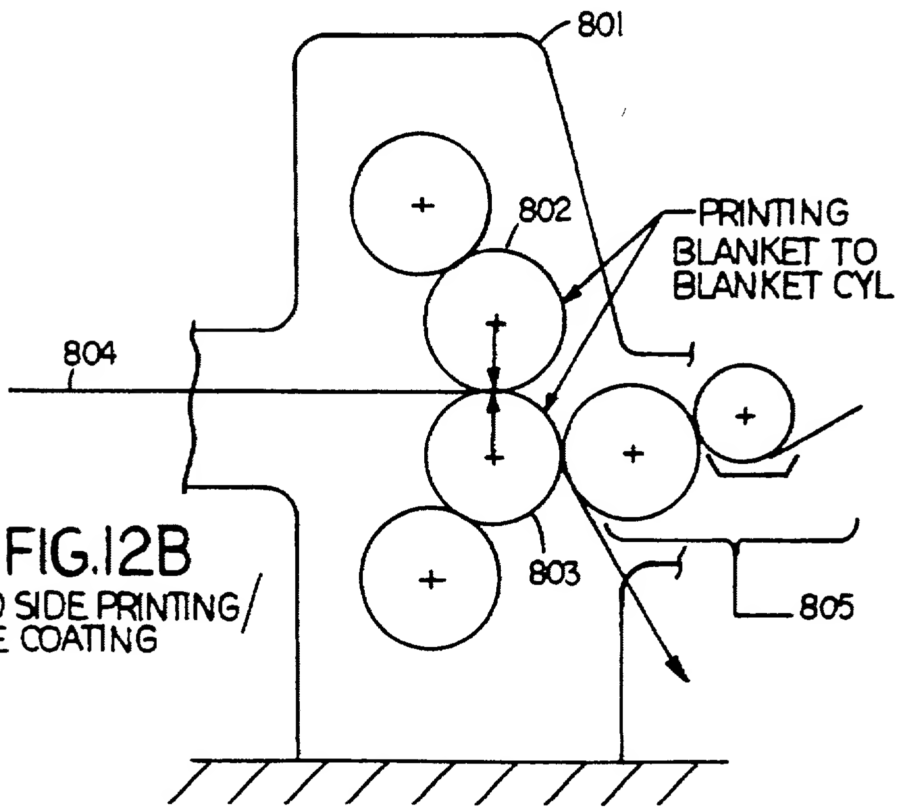


FIG. 12B
TWO SIDE PRINTING/
SIDE COATING

RETRACTABLE COATER ASSEMBLY INCLUDING A COATING BLANKET CYLINDER

BACKGROUND OF THE INVENTION

This application is a continuation-in-part of PCT/US 90/03338 filed Jun. 13, 1990, which in turn was a continuation-in-part of U.S. Ser. No. 365.680, filed Jun. 13, 1989 and now U.S. Pat. No. 4,934,305.

This invention relates to coating printed workpieces, e.g. sheets. It more particularly refers to a process and apparatus for coating workpieces which have been printed on offset printing equipment.

In many applications it is desirable to apply a spot or overall coating to a printed workpiece. For example, a UV curable or water-soluble polymer finish may be applied to a workpiece printed by offset lithography. The coating is quickly dried while the surface of the ink is still tacky. This coating avoids the need for powder driers sprayed between sheets to present offsetting of oxidation-dried inks that are slow to dry. These coatings are also useful for providing a glossy finish that improves the rub-resistance of the workpiece and improves its overall appearance and feel. Finally, adhesive coatings may be applied to printed packaging; for example, heat-set adhesives may be applied to enable attachment of a feature such as clear plastic bubble of a package used to display the product. It is said that ultraviolet-cured and aqueous overprint coatings are, by some measurements, the fastest growing segments of the printing industry.

Application of coatings to a workpiece is made difficult by various requirements. For example. the coating should be uniform and its thickness should be controlled. Moreover, the aqueous coating should be applied quickly, before its vehicle evaporates causing it to thicken. Finally, it is desirable for the coater to operate "in-line" with the press that prints the workpiece to take full advantage of the fast-drying capability of coatings and generally to simplify the manufacture of printed coated workpieces.

Butler U.S. Pat. No. 4,270,483 discloses an in-line coating apparatus for attachment to a conventional offset lithographic printing press. The apparatus includes a set of rollers (i.e., pick-up roller **14** and application roller **16**) to deliver coating material from a reservoir **18** to a standard press unit blanket roll **108**. A metering rod **40** meters the amount of coating transferred to application roller **16**.

An in-line coater sold by Norton Burdett Co. of Nashua, N.H. has a single roller driven directly by a D.C. motor. The roller is a gravure cylinder that transfers coating to a standard press unit blanket cylinder. The coater is attached to a pivoting arm, and the unit can be pivoted away from the press unit when the coater is not in use.

Another in-line coater, sold by IVT Colordry, Inc. of Fairfield, Conn., applies coating from a reservoir pan to a standard press unit blanket cylinder using a pick-up roller that delivers a coating supply to an applicator roller; the applicator roller applies the coating to the blanket cylinder of a press unit.

Kumpf U.S. Pat. No. 3,768,438 discloses a coater in which a fountain roller dips into a coating reservoir and transfers liquid coating material to a feed roller. The feed roller in turn transfers coating material to a coating roller that coats a sheet fed between the coating roller and a format roller.

DiRico U.S. Pat. No. 4,685.414 discloses a process and apparatus for use in combination with an existing press unit wherein the coating means is retractable, to be used or not as the printer requires. In this device, the coating means utilizes the blanket roll of the last unit of the press, and this last unit cannot be used for color application means when it is used for coating. For example in a four color press, utilizing the coating apparatus of the '414 patent would then permit only three colors to be printed in in-line, single pass operation.

Bird U.S. Pat. No. 4,796,556 discloses an offset lithographic apparatus with a plate cylinder and a blanket cylinder, and an in-line coater to apply liquid coatings either in a pattern or over the entire workpiece. The apparatus has a carriage which moves the coater between a first position operative association with the plate cylinder of the lithographic press unit (see full line of unit **72** in FIG. **1**) and a second position in operative association with the blanket cylinder of the lithographic press unit (see broken line of unit **72** in FIG. **1**). In the first position the coater applies spot coating, and in the second position the coater applies coating over the entire sheet.

Satterwhite U.S. Pat. No. 4,308,796 discloses apparatus for adapting an offset lithographic press to flexographic operations, the flexographic operation being either for coating or printing. Coating is achieved by applying a photosensitive plate to the lithographic blanket roll of the offset press. A transfer roll supplies coating to the plate. Inking is achieved in a like manner but with a flexographic plate having raised image areas.

Makosch U.S. Pat. No. 4,397,237 discloses a pivoting secondary inking system ("B" in FIG. 2).

Preuss et al. U.S. Pat. No. 3,391.791 discloses a sheet coater which moves into engagement with various cylinders in a press delivery area.

Knodel et al. U.S. Pat. No. 3,916,824 discloses a coating assembly which includes a fountain roll. a metering roll and an applicator roll for coating band of ribbon material. The coater is horizontally displaceable on an auxiliary frame.

Jahn U.S. Pat. No. 4.615,293 and 4,706.601 disclose separate duplex coating units disposed downstream of a printing press. The units permit coating of selected portions of the workpiece using a relief plate or permit blanket coating.

Switall U.S. Pat. No. 4,617,865 discloses a coater that can be pivoted into and out of position in contact with the blanket cylinder of the press unit; the coater being retractable with the same limits as that of the Di Rico device, i.e., the coating and printing functions cannot be performed simultaneously.

Jirousek U.S. Pat. No. 2,320,523 discloses a self-adjusting dampening roll.

Edwards U.S. Pat. No. 4,222,325 discloses a retractable dampening and inking unit.

Egnaczak U.S. Pat. No. 3,800,743 discloses a coater for a photoelectrophoretic process.

DeLigt U.S. Pat. No. 3,397,675 discloses a coating or printing station having its applicator and transfer rolls attached to pivotally mounted supporting frames.

Some commercial presses, such as Heidelberg GTO and MO include an extra blanket cylinder e.g.. for numbering, printing extra colors, perforating, center slitting. etc. This added cylinder is a fixed part of the press, and

does not retract with associated equipment for numbering or imprinting.

SUMMARY OF THE INVENTION

This invention generally features a coating apparatus that operates on line with an impression cylinder of a lithographic printing press to apply a liquid coating to a workpiece. The invention is particularly (but not exclusively) adapted to sheet-fed lithographic presses. The coating apparatus of the invention has an integrated, independent, cooperatively operating, coating assembly whose components include a liquid coating supply means, a special coating blanket cylinder (in addition to any blanket cylinder(s) that are already part of the press), and means for metering and transferring coating material operatively connected to the coating blanket cylinder and to the liquid coating supply means, for controlling the amount of coating supplied onto the coating blanket cylinder from the supply means. Structural members integrate the means for metering and transferring coating and the coating blanket cylinder into the coating assembly so that the coating assembly components remain fixed relative to one another as the assembly moves relative to the impression cylinder of the press. The apparatus also includes a means for positively driving the coating blanket cylinder in association with the press unit impression cylinder and mounts for guiding movement of the coating assembly between an operative position, in which the coating blanket cylinder is operatively engaged with the press unit impression cylinder, and an off-imprint (or off-impression) position, in which the coating blanket cylinder and drive is slightly separated from the impression cylinder (i.e., separated sufficiently to prevent contact). In the operative position the coating blanket cylinder can be accurately adjusted relative to the impression cylinder. Moreover, the coating assembly can be actuated so the coating blanket cylinder is slightly separated from the impression cylinder. Such adjustment and actuation are achieved without a change in the coating blanket cylinder position relative to the coating metering and transfer means.

One embodiment of the system is especially adaptable to press types such as the Heidelberg Speedmaster TM line of presses, where there is access between the press blanket cylinder of the last press unit and the sheet transfer cylinder of the delivery to add a blanket cylinder for coating on the impression cylinder of the press unit In this embodiment, the press impression cylinder which engages the coating assembly is also operatively associated with the printing blanket cylinder on the press. In operation, a sheet on the impression cylinder contacts the printing blanket at a first location on the sheet while it contacts the coating assembly blanket at a second location on the sheet, enabling simultaneous printing and coating at a single impression cylinder.

Alternatively, in other embodiments for presses that cannot accommodate the coating assembly at the press impression cylinder, it is possible to replace (retrofit) a press transfer cylinder with an impression cylinder that can accommodate the coating blanket cylinder of the coating assembly. For example, where the printing press comprises an accessible transfer cylinder, an impression cylinder may be retrofit into a position ordinarily occupied by the transfer cylinder. One version of this embodiment features using the coating assembly at an impression cylinder that has been retrofit in place of a transfer cylinder upstream from a tower coater. In this embodiment, the sheet workpiece is precoated prior to coating at the tower coater.

Yet another preferred embodiment of the invention features retrofitting a fixed coating tower with the coating assembly of the invention. The fixed coater has an impression cylinder operatively connected to a fixed coating blanket cylinder. The coating assembly is retrofit to the fixed coating impression cylinder so that the coating assembly blanket cylinder of the invention and the fixed coating blanket cylinder both operate simultaneously on the fixed coating impression cylinder. In this way, two layers of coating are applied simultaneously to the same workpiece.

The coating blanket cylinder of the coating assembly is adapted to provide a coating surface, which preferably is the generally same basic diameter as the standard printing blanket cylinder. By "adapted to provide a coating surface", we mean that the coating blanket cylinder can receive a standard resilient blanket, or it can receive a relatively hard or resilient relief plate or its equivalent. Alternatively, the cylinder could have a surface with permanent relief. For spot-coating, the coating blanket cylinder carries a photopolymer relief plate or equivalent. This cylinder is also preferably equipped for circumferential and lateral (side) register to enable accurate positioning of the plate. Pin register may also be supplied for pre-positioning of the plate relative to the positions of upstream printing plates. Pin-register may be supplied in lieu of, or, in conjunction with circumferential and side register means. The photopolymer plate may be installed in the same blanket reels or clamps as provided for the blanket, or, may be attached to the cylinder, independent of the blanket clamping provisions. The coating blanket cylinder continuously delivers a smooth, uniform metered amount of liquid coating material to the workpiece carried on the press unit impression cylinder.

Preferred embodiments of the invention are characterized as follows. The mounts guide the coating assembly to move to a fully retracted position in which the assembly and particularly the coating blanket cylinder are completely disengaged from the press unit impression cylinder at a remote location from the press unit cylinders. The coating transfer means comprises a transfer (delivery) cylinder (e.g. an engraved or smooth cylinder) in operative contact with the coating blanket cylinder, as well as a metering means (an elongated blade or a metering roll) for metering the amount of coating carried on the transfer cylinder. The coating assembly is mounted on an inclined support attached to the press frames of the delivery section of the press. Means are provided for moving the coating apparatus toward or away from the press unit. Specifically, these means can include a hydraulic cylinder. Coating is circulated by recirculation means. Coating is supplied between the transfer means and the metering means, flows longitudinally along the length of the transfer and metering means and cascades at the ends thereof to a drip pan positioned below the metering means. A drip pan outlet is in operative association with the recirculation means, and the coating supply means communicates with the recirculation means, to supply recirculated coating to the transfer and metering means. The coating blanket mounted on the blanket cylinder and the press unit blanket cylinder have substantially the same effective operating diameter. The apparatus includes means to control pressure or width of the nip between the transfer cylinder and the coating blanket

cylinder. The apparatus also includes means to control the actuation, adjustment and speed of the transfer cylinder relative to the blanket cylinder. A gear is adapted to positively, drivingly, couple the coating blanket cylinder to the impression cylinder when the assembly is in the first (operating) position. This gear can be made of a special plastic material. Additionally, the impression cylinder includes a gear adapted to drive the gear on the coating blanket cylinder. Means are provided for registering the coating blanket cylinder gear with the adjacent impression cylinder gear. Proximity sensors located on the coating blanket cylinder gear and the impression cylinder gear are utilized to rotationally align these gears with one another. The press will not start unless the gears are sensed to be in the proper position relative to each other. The apparatus also includes means for adjusting the coating blanket cylinder relative to the press unit impression cylinder while the two cylinders remain drivingly engaged. An adjustable stop controls the nip between the coating blanket cylinder and the impression cylinder, without changing the relationship between the coating blanket cylinder and the liquid coating metering and transfer means. Specifically, this stop can be a threaded screw. The coating blanket cylinder is preferably lightweight (aluminum) with means enabling lateral and/or circumferential register adjustment relative to the adjacent press impression cylinder. Circumferential register adjustment means includes a plurality of bolts and nuts, as well as correspondingly positioned slots in a plate secured to the coating blanket cylinder, which are adapted to allow for rotational movement of the coating blanket cylinder with respect to the coating blanket cylinder gear. Lateral register adjustment means includes threaded collars adapted to allow for lateral movement of the coating blanket cylinder, located at both ends of said coating blanket cylinder. There is provided a means of locking the coating apparatus to the press unit. Specifically, the means can include a cylinder clevis and a press-mounted lug, cooperatively sized and positioned to engage said clevis, and a releasable latch pin adapted to connect the clevis to the lug. Alternatively, the means can include a pair of cooperatively sized and positioned electromagnets which, when de-energized, allow the coating assembly to be released for movement to a location remote from the press unit.

This invention thus provides a direct coating system for a sheet fed printing press, preferably a multi-color press, and enables in-line printing and coating at the same time on a single press unit, thus maintaining the printing capability of the printing press unit. When a press unit (preferably the final press unit) is retrofitted with the retractable coating assembly of this invention, an existing impression cylinder in the press unit may act as a common impression cylinder, so that ink is first applied to a sheet being fed on the impression cylinder and a coating is applied directly to the sheet over the last ink application. After this dual sequential application of ink and coating onto a sheet on the same impression cylinder, the coating can be suitably dried by air, infra-red heat, ultra-violet radiation or any other means adapted to quickly dry the coating.

This apparatus is capable of delivering a metered amount of coating through a special blanket roll to a sheet carried by the last impression cylinder in a printing press substantially without interrupting or changing the printing process. It allows spot coating or overall coating as may be desired by the printer. It operates without the use of bulky complex metering systems, yet the apparatus is versatile in that the printer can bring the coater in line or not, as he desires, without changing or interfering with an existing printing operation. Adjustment of the coating blanket cylinder and entire assembly is made relative to the impression cylinder to compensate for various sheet thicknesses to be printed. The assembly is furthermore actuatable while still drivingly engageable with the impression cylinder, to on-off positioning of the cylinder when operating in the first position.

The entire apparatus is further retractable to the second position by a simple retraction device, such as a linear-actuator, winch, hydraulic cylinder or the like, up an inclined plane (the same plane as for movement for adjustment and actuation), to provide access to: (1) the coating blanket cylinder for changing blankets, packing, clean-up, maintenance, etc.; (2) the standard printing blanket cylinder; (3) the impression cylinder; and (4) the sheet delivery area, beneath the coating apparatus, housing the conventional Infra-red or UV drying unit. In this second retractable position, the apparatus may be used as a seat by the operator, as desired, for standard printing press unit operation.

A gear cover is provided about the blanket cylinder gear and is designed to resiliently sealingly engage the gear cover of the printing unit to which the coating apparatus is installed. When the coating unit is retracted, a cover is supplied to seal the cutout in the press gear cover. Therefore the integrity of the oil bath is maintained within the press gear cover in both operating and retracted positions of the apparatus.

A specific sequence of actuation of the transfer roll relative to the coating blanket cylinder, and actuation of the coating blanket cylinder (and, therefore, of the entire assembly) relative to the impression cylinder for proper coating operation, is specifically discussed later herein. This apparatus is well adapted to be built into a new printing press or to be retrofitted into existing equipment.

Other feathers and advantages of the invention will be apparent from the following description of the preferred embodiment.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side view of the coating apparatus including a diagrammatic view of a printing press with which it is operatively associated. In this Figure the cylinders of the coating assembly are shown in solid in their coating operating position and in phantom in their retracted position. The coating apparatus is shown in section.

FIG. 1A is a side view of stop on the coating apparatus of FIG. 1.

FIG. 2 is a diagrammatic side view of a set of coating application rollers showing details of controls for positively, drivingly, linking these rollers to a printing system; and

FIG. 3 is similar to FIG. 2 showing a schematic view of controls for the coating apparatus hereof for adjustment, actuation and retraction of the coating assembly relative to the press, actuation and adjustment of the transfer roll relative to the coating blanket cylinder and the metering means relative to the transfer roll.

FIG. 4 is a cross-sectional view taken along lines 4—4 from FIG. 1.

FIGS. 5 and 6 are diagrammatic representations of two alternative embodiments of the invention, respectively, in which the coating assembly is engaged with an

impression cylinder retrofit in place of a transfer cylinder.

FIGS. 7 and 8 are diagrammatic representations of yet two additional embodiments of the invention, respectively, in which the blanket coater of the invention is employed with a coating tower on either an impression cylinder retrofit at a transfer cylinder of the last press unit, or directly on the impression cylinder of the coating tower.

FIG. 9 is diagrammatic illustration of the means of locking the blanket coating cylinder to the press impression cylinder.

FIG. 10 is a diagrammatic illustration of the means of circumferential register adjustment.

FIG. 11 is a diagrammatic illustration of the means of lateral register adjustment.

FIGS. 12*a* and 12*b* respectively show the coating assembly adapted to single-sided, and to two-sided, web printing applications.

SPECIFIC EMBODIMENTS OF THE INVENTION

This invention will be described with reference to the drawing in which like parts have been given like reference characters.

Referring now to FIGS. 1 and 4, the coating apparatus assembly of this invention comprises a transfer roller 10, journalled for rotation, onto which is fed coating material 12, and a metering assembly 14 which is suitably adjustably mounted relative to the transfer roll to deliver a predetermined quantity of liquid coating, substantially evenly along the surface of the transfer roller 10. This metering assembly 14 includes a rotatably mounted journal 20 which is generally parallel to the axis of the coating transfer roller 10. Mounted substantially centrally about the journal 20 is a housing 22 from which a blade clamp 24 extends. A doctor blade 26 is positioned in the blade clamp 24 and is angularly positioned against the transfer roller 10. The doctor blade 26 is suitably made of blue spring steel, suitably about ten thousandths of an inch thick, and suitably extends out of the clamp 24 about one half inch. The angular position of the blade 26 may be about 40° to a tangent to the transfer roller surface. It has been found to be useful to force the doctor blade 26 against the transfer roller 10 with a pressure of about one half to one pound per linear inch. The transfer roll (with the metering device) is mounted at each end thereof in a common frame 16 which is in turn rotatably supported in a coater assembly housing 46. Frame 16 is pivotally rotated, or otherwise moved, by cylinder 57, not shown, to adjustably engage transfer roll 10 to a lightweight (e.g., aluminum) coating blanket cylinder 40 for proper coating application. Movement of frame 16 does not affect pressure between roller 10 and blade 26. Likewise, movement of housing 46 does not affect the pressure setting, or the relative positions, of transfer roll 10 and coating blanket cylinder 40. Adjustable stop 18 is provided to set a light "kiss" pressure between roller 10 and cylinder 40.

A drip pan 28 having an outlet is provided, and is positioned below the transfer roller 10 and the metering assembly 14. The pressure exerted by the doctor blade 26 against the transfer roller 10 can be adjusted by means of two adjustment screws 27 which extend to corresponding adjustment brackets 29 clamped on the axle 20. It is preferred that the adjustment screws are attached to the brackets off center with respect to the axis of the axle 20 so that the rotation of these adjustment screws will pivot the axle 20 whereby changing the pressure of the doctor blade 26 on the roller 10. A cover may be provided over the coating 12 and roller 10.

A coating blanket cylinder 40 is provided in operative, takeoff contact with the transfer roller 10. The blanket roller has its own journals rotatably mounted, suitably in needle bearings, and supportingly attached to the same housing 46 as supports the common frame 16 for the transfer roller and metering assembly. This housing 46 is slidably mounted on rails 48 which, in a preferred embodiment of this invention, are inclined so as to easily move the coating assembly into and out of the line as well as provide a guide for adjustment and actuation of the coating blanket cylinder (and entire unit) relative to the impression cylinder of the press.

Specifically, the housing 46 is mounted on bearing blocks 50 that are in turn slidably mounted on the two parallel rails 48. The rails 48 are mounted on rail supports 52 which are adapted to be directly connected to the press unit.

Hydraulic cylinders 58 each with an adjustable clevis 62 are mounted on opposite sides of the housing 46 to provide proper actuation and a "kiss" pressure contact between the coating blanket on the special blanket cylinder 40 and the sheet on press impression cylinder 66. Suitably a latch 60 is provided to insure positive positioning and lock-up of the entire coating assembly with relation to the printing unit, i.e., the coating blanket cylinder 40 with the impression roller 66.

Double adjusting screws 30 and 32 are supported by support 36 attached to housing 46. Screw 30 bears against stop block 38, attached to the press frame. Screw 32 is locked by nut 34. Rotation of screw 30 provides for paper pressure adjustment and thickness changes in sheet stock, while setting screw 32 provides a safety such that gears mounted on the coating blanket cylinder and press impression cylinder, cannot be meshed beyond a preset point while in the coating mode of operation. Once nut 34 is tightened, the nut is fixed (as if it were welded or pinned) for a specific screw 32 setting. Clearance "S_c" in FIG. 1 depends on the thickness of the sheet, S_t which is generally between 0.000 to 0.030 inches. As shown in FIG. 1, clevis 62 is adjusted such that a clearance exists within cylinder 58, between the piston and cylinder wall. The piston serves as an "OFF" stop for the coating assembly when the assembly is actuated. A separation will therefore exist between the blanket and sheet when in the "OFF" impression position. For a theoretical 0.000 sheet thickness, S_c should be set for 0.060 inches approximately.

A gear-motor 80, which may be hydraulic or electric, is suitably provided to drive the transfer roll 10. Suitable means is provided to retract the coating assembly into and out of operative relation with the impression roller 66, up and down the rails 48.

The coating assembly is shown in cooperative relationship with a conventional series of printing rollers. The coating blanket on blanket cylinder 40 is in light "kiss" contact with the sheet on impression cylinder 66, the sheet on the impression cylinder being also in contact with a printing blanket on blanket cylinder 70; impression cylinder 66 thereby serves as a dual impression cylinder, first for printing and next for coating. The sheet work piece is shown at 72.

The coater is first locked into operation on the press unit by lowering it along the rails 48 toward the press unit and engaging clevis 62 to lug 61 mounted on the

press through releasable latch pin **60**. In operation, gearmotor **80** mounted on housing **46** rotates the roller **10** as coating fluid is pumped under pressure from a fluid reservoir (not shown) to an inlet opening in the doctor blade assembly. From there, coating spreads over the surface of roller **10** and is distributed by the doctor blade **26**. A continuous flow of coating is maintained over the surface of the roller **10** and excess coating is recovered through drip pan **28**, with an outlet for recycling. In this way, sufficient flow is maintained to provide a flooded nip of coating between roller **10** and blade **26** and to provide uniformity of coating along the rollers' length. The amount of coating carried by the transfer roller **10** can be adjusted somewhat by turning screws **27** to adjust the pressure between doctor blade **26** (or a metering roller) and the transfer roller **10**, as described above. Hydraulic cylinders **58** serve to pull the entire unit against the press with a force that can be adjusted by adjusting the pressure in the cylinders **58**. Screw **30** adjusts "ON" pressure between the coating blanket on blanket cylinder **40** and a sheet carried on impression cylinder **66**. Cylinders **58** further serve to separate the coating blanket cylinder from the impression cylinder while gears mounted on the adjacent cylinders still remain in mesh. Separation or clearance "S_c" in FIG. **1** is about 0.060 to 0.030 inches to provide an "OFF" condition of the coater assembly to stop application of coating. As the blanket cylinder **40** rotates in direction R, coating is applied to the just printed sheet. Transfer roller **10** rotates as shown by direction R'.

A uniform amount of liquid coating is continuously transferred to the blanket roller **40** at the nip between the blanket roller **40** and the transfer roller **10**. The blanket roller **40** in turn delivers that coating to the workpiece as the workpiece travels through the nip between the blanket roller **40** and the impression roller **66**. Changing the speed of roller **10** results in a change of coat weight added to the sheet.

When the coater is not in use, latch pin **60** is released, and a suitable means moves the coating unit back along the rails **48** away from the printing rollers.

More specifically, when using an acrylic water-based coating, a suitable transfer roller may be a quadrangular cell cylinder, having about 140 lines/inch, each square inch of cells carry 15 cubic billion microns of coating. A suitably engraved roller is sold by Pararco Roller Co. of Dallas, Tex. (Exact roll cell nomenclature is: 140 Rotoflo/138 for an optimum roll surface structure.) An acrylic water-based coating having about 45% solids can be applied to achieve an optimum dry coat weight of ~0.4–0.6 pounds per 1000 square feet, using a roll surface speed of 1:1 with that of coating blanket roll **40**.

Referring now to FIG. **2**, there is shown a portion of a coating apparatus assembly including transfer roller **10**, coating material **12** fed from a supply thereof **13** and metered onto the roller by means of a doctor blade assembly **14**, including a drip pan **28**. The transfer roller **10** is suitably driven by direct drive gear motor **80** whose speed is controlled by a controller **82** responding to sensor **84** which senses the speed of the coating blanket cylinder **40**. Controller **82** is adjusted to provide a preset surface speed ratio, 1:1 or less, between roller **10** and cylinder **40**, the slowest surface being that of roller **10**. Impression cylinder **66** includes a sheet gripper **95**. The coating blanket on blanket cylinder **40**, and associated drive gear **40'**, preferably have the same operative diameter as the impression cylinder **66** and press gear **66'**. Gear **40'** is directly driven by press gear **66'** of cylinder **66** so as to insure a positive synchronized drive relation there between. In FIG. **2**, no worksheet is shown in this figure for clarity. Index marks are placed on adjacent gears to insure proper register of adjacent cylinders. The gear pitch line separation "P.L.S." is approximately equal to the sheet thickness "Sht.Thk.", S_t, shown on cylinder **66**. D_{40} is a broken line corresponding to the outer diameter of the blanket on cylinder **40**, and the pitch line of gear **40'** and D_{66} is a broken line corresponding to the outer diameter of impression cylinder **66** and the pitch line of gear **66'**. R_{40} is equal to R_{66} and thus D_{40} and D_{66} are equal.

Referring now to FIG. **3** which is similar to FIG. **2**, there is shown the same three rollers, the transfer roller **10**, the coating blanket cylinder **40** and the dual, common, impression roller **66**. The transfer roller **10** and the coating blanket roll **40** are shown commonly mounted in assembly **46** via bearing blocks **50**, on inclined rails **48**. There is shown in this figure a first cylinder **57** with stop **18** which adjusts the pressure in the nip **90** between the transfer roller **10** and the coating blanket on blanket cylinder **40**. A second cylinder **58** and screw **30** are provided to control the spacing in the nip **94** between the coating blanket on the blanket cylinder **40** and the dual impression cylinder **66** to accommodate a particular sheet thickness. The last color printing blanket roll **70** is not shown for clarity. Frame **16** pivots at P in FIG. **3**.

FIG. **4** is a sectional view taken along lines **4—4** of FIG. **1** showing relationship or roll lengths to each other, a cover A' about the coating blanket cylinder drive gear, lateral and circumferential register provisions for the coating blanket cylinder, B' and C' respectively and other component parts shown in FIG. **1**.

As best shown in FIG. **4**, housing **46** is offset to the inside of the press frame in the area of the bearings for coating cylinder **40**, and therefore clears the press frame in this area. The remainder of the housing may lie along the inclined surface of the frame; that is, directly above the frame. This offsetting of housing **46** prevents having to alter (cut away) a portion of the press frame adjacent the bearing.

For sequencing of rolls for proper coating operation, the following procedure is followed:

"ON"	1. Transfer roll actuates to coating blanket cylinder upon actuation of press blanket cylinder of last printing unit
	2. Coating blanket cylinder actuates to sheet on press impression cylinder upon one full revolution of press.
"OFF"	1. Transfer roll separates from coating blanket cylinder upon actuation of blanket cylinder of preceding press unit.
	2. Coating blanket cylinder separates from the sheet on the press impression cylinder upon actuation of the press blanket cylinder of the last printing unit

An alternate embodiment is shown in FIG. **5**, which is particularly applicable for press units which cannot accommodate a coating assembly according to the invention in operable association with the press unit blanket cylinder as described above. In FIG. **5**, an impression cylinder is installed downstream of the final press unit, in place of a sheet transfer cylinder which ordinarily transfers the workpiece along a path from the final unit to the press delivery.

Specifically, press units **100** and **101** generally correspond to the Miehle Super 60" press. The positioning of certain cylinders in that press does not permit installation of a coating assembly as described in the embodiment of FIG. 1. Existing press unit **101** includes sheet transfer cylinders **102**, an impression cylinder **103**, and plate and blanket cylinders **104** and **105**. Ordinarily, the cylinders at positions **106** and **107** are also sheet workpiece transfer cylinders to transfer the workpiece from the final unit **101** to the delivery area **120**.

According to the invention, the sheet transfer cylinder ordinarily occupying position **106** is replaced by an impression cylinder which cooperates with a retractable coating assembly having a coating blanket cylinder **140** as described above. Other components of the coating assembly of FIG. 5 (e.g., transfer cylinder **110** and metering assembly **114**) are the same as described above and require no further description. The operation of the apparatus of FIG. 5 is analogous to the operation of the above-described apparatus of FIGS. 1–4, and the coated sheet is transported to the press delivery.

FIG. 6 shows a similar arrangement for a small (25") Heidleberg MO ® press, in which a double-size sheet transfer cylinder at position **201** has been replaced with a double-size impression cylinder. A retractable coating assembly **202** according to the invention is positioned in operative association with the impression cylinder at **201**. Coating assembly **202** includes a coating blanket cylinder **240** and a coating transfer cylinder **210**.

FIG. 7 shows an arrangement featuring the use of a coater on a press that includes a Heidleberg coating tower **301** downstream from the final press unit. The coating tower includes a standard coating unit **302**, having an application cylinder **303** which applies coating to a workpiece nipped between application cylinder **303** and coating impression cylinder **309** for applying a coating. A retractable coating assembly **304** according to the invention can be added by replacing the transfer cylinder at position **303** with an impression cylinder, and adding the coating assembly **304** upstream from the standard unit **302**. Coating assembly **304** includes a retractable blanket cylinder **340** and a coating transfer cylinder **310**, each of which is substantially similar to the coating cylinders described in FIGS. 1–4. The workpiece is transferred via transfer cylinder **308** to coater **301**. In this way, it is possible to apply a water-based pre-coat to the sheet workpiece at unit **304**, upstream from the application of a U.V. sensitive coating at standard unit **302**. The precoating is dried before the U.V. coating is cured at station **307**. After coating, the sheet is presented to the press delivery **320** in the standard way. Such a double coating system is particularly useful where the ink and the U.V. coating are not compatible, requiring the intermediate pre-coating layer to separate them.

FIG. 8 shows an alternative retrofit of the coating tower shown in FIG. 7. Specifically, the cylinder in position **403** is a standard transfer cylinder. Coating impression cylinder **404**, which is part of the standard coating unit **402** serves to apply a second layer of coating from the coating assembly **405** according to the invention, which is retrofit to work in cooperation with impression cylinder **404**. Coating assembly **405** includes a blanket cylinder **440** and a transfer cylinder **410** as described above. The remainder of the coating tower and delivery is generally as described for FIG. 7, and further description is not necessary here. The embodiment of FIG. 8 is useful for applying a double layer of coating at a single impression cylinder, with the first layer being applied by the standard coating unit **402** and the second layer being applied as described above.

Another alternate embodiment is shown in FIGS. 9–11 which includes alternative features of the coating unit embodiment illustrated in FIGS. 1–4.

A different method of "locking" the coating unit (e.g. the unit of FIG. 3) to the press is illustrated in FIG. 9. The coating unit is displaced down the rails **48** by means of a hydraulic cylinder **500**. Once in the vicinity of the press, electromagnets **502**, **504**, located on the press and the coating unit, respectively, mate and attach the coating unit to the press. These electromagnets act to maintain the relative positions of the two units and therefore serve to replace latch pin **60**, lug **61**, and clevis **62**.

Before attaching the coating unit, a registering process is initiated. Registering refers to aligning the coating unit with the press in an operative position. More specifically, registering aligns the teeth of gear **66'** attached to the press impression cylinder **66** to those of another gear **40'** attached to the coating blanket cylinder **40**. Additionally, when the gears have been properly aligned, the sheet gripper is in its proper position relative to (and is registered with) the blanket gripper and gap on cylinder **40**. Proximity sensors **506**, **508** (or their equivalent) are attached to gear **66'** and gear **40'**, respectively, and are placed near the perimeter of the gears. Both gears **66'**, **40'** are rotated relative to one another until these sensors **506**, **508** are in their nearest proximity, indicating proper orientation. The gear teeth are then brought together in a mesh configuration, and index marks of FIG. 2 will be as shown.

Gear **40'**, attached to the coating blanket cylinder, is made of a resilient plastic material (i.e. MC901 Nylon). The purpose of manufacturing the gear out of plastic is to avoid problems associated with uneven gear wear. Metal gears in a gear train that have differencing amounts of wear may not mesh properly and may cause poor quality printing. Therefore, all metal gears in a gear train are usually replaced concurrently so that wear is matched for all gears in a set. A plastic gear on the retrofit blanket cylinder can adjust to the wear of the press gear **66'** because of its ductile and resilient qualities. Therefore, coating unit gear **40'** can be maintained independently of press gear **66'** and can be retrofitted or replaced independent of the state of wear of press gears without interfering with the quality of the printed material.

When the coating unit is locked to the press, it sometimes becomes necessary to realign the coated blanket cylinder **40** without separating the coating unit from the press. Therefore, both circumferential and lateral adjustments are possible.

Means for circumferential adjustments are illustrated in FIG. 10. The gear **40'** attached to the coating blanket cylinder **40** includes a hub **650**. Atop the hub **650** is a face plate **652** which is secured to the coating blanket cylinder shaft **654** (shown on end view). Four bolts **658'**, attached to the hub **650** extend out of the hub through four machined slots **656** in the face plate **652**. Four nuts **658** are tightened on the bolts and are utilized to fasten the face plate **652** and shaft **654** to the gear hub **650**, thereby fixing the rotational orientation of the coating blanket cylinder **40** to the gear **40'**. To adjust the cylinder orientation with respect to the fixed gear position, the nuts **658** are loosened, and the face plate **656** and shaft **654** are rotated relative to the gear hub. Appar-

ently, the limits of rotation are defined by the circumferential length of the machined slots 656.

Means for lateral adjustments are illustrated in FIG. 11. Coating blanket cylinder 40 is attached to a shaft 654 at both ends. Gear 40' is mounted on one end of this shaft 654 (as described above). The lateral position of the cylinder 40 is maintained via shaft collars 600. The shaft collars 600 are placed on opposite ends of the shaft, and when secured, do not allow for lateral motion of the cylinder with respect to the shaft. Cylinder 40 is preferably keyed to the sheet 654 to prevent circumferential movement of the cylinders relative to the shaft. These collars have internal threads, and the shaft hollow tubes having an inner diameter is threaded externally.

Each shaft collar 600 includes inner screw threads which mate with outer screw threads 602 contained on the shaft 654. To move the cylinder 40 in a lateral direction, shaft collars 600 are loosened on the cylinder which specifically entails rotating these collars on their threads away from the cylinder, to free the cylinder to be laterally displaced on the shaft in either direction. When a desired position is achieved, the cylinder 40 is again tightened to the shaft 654 by rotating the shaft collars 600 on their threads toward the cylinder and into a tight fit against the cylinder. The force of the shaft collars against the cylinder act to lock the cylinder in a fixed lateral orientation relative to the shaft.

FIGS. 12*a* and 12*b* show the coating unit adapted for two different web offset presses to coat, e.g. with a U.V. coating). In FIG. 12*a*, press unit 701 is a single-sided web offset lithographic press, having a printing blanket cylinder 702 and an impression cylinder 703 for printing web workpiece 704. Coating unit 705 includes metering cylinder 706 and blanket cylinder 707, as described above.

In FIG. 12*b*, press unit 801 is a double sided (blanket-to-blanket) web offset lithographic press unit in which blanket cylinders 802 and 803 print opposite sides of web workpiece 804 simultaneously. Coating unit 805 operates in associating with blanket cylinder 803 to coat the top side of web 804.

OTHER EMBODIMENTS

Other embodiments are within the following claims. For example, other doctor blade arrangements may be used to doctor the coating from the transfer roller 10, such as a system utilizing a reverse angle blade or having dual blades and having a coating inlet between the two blades. A roll, or roller means, may also replace the doctor blade arrangement. Other types of engraved or smooth surfaced cylinders may be used. Those skilled in the art will appreciate that the coating unit described above may be adapted to achieve numbering, slitting, scoring, and the like. Moreover, the coating unit described above may be used to deliver varnishes, coatings, glues, dyes, etc. in addition to coatings. Other types of presses may be used in conjunction with the coater, but offset lithographic sheet-feeding presses are preferred. For example, the coating unit may be adapted to web offset press printing.

What is claimed is:

1. A coating apparatus for applying a liquid coating to a workpiece in co-operation with an impression cylinder mounted on a lithographic printing press, said press having at least one ink carrying surface for applying ink to said workpiece prior to coating, said coating apparatus comprising,

a) an independent, cooperatively operating coating assembly comprising:

i) a liquid coating supply means;

ii) a coating carrier which includes a resilient coating carrying surface for carrying liquid coating;

iii) a means for metering and transferring liquid coating, operatively connected between said coating supply and said carrying surface, for maintaining a controlled amount of liquid coating on said coating carrying surface; and

iv) structural members integrating said means for metering and transferring liquid coating and said coating carrier into said coating assembly;

b) supports for allowing movement of said coating assembly between: i) an operative position in which said coating surface on said carrying surface is in rotative pressure contact with a workpiece on said press unit impression cylinder; and ii) a fully retracted position in which said coating assembly is completely disengaged from said press unit impression cylinder at a location remote from the press unit impression cylinder, said coating assembly, including said coating carrier and said means for metering and transferring coating material, remaining connected during said movement;

whereby, in said operative position, said carrying surface continuously delivers a smooth, uniform, metered amount of said liquid coating material to said workpiece on said impression cylinder.

2. The coating apparatus of claim 1 in which said coating assembly comprises:

a) a roller means for metering and transferring a uniform predetermined quantity of coating to said resilient carrying surface on said coating carrier, said coating supply means being operatively associated with said roller means;

b) a movable support for said coating carrier, for moving said coating carrier into and out of contact with said workpiece on said impression cylinder;

c) a movable support for said roller means for moving said roller means into and out of contact with said coating surface on said coating carrier;

d) means for integrating said coating carrier and said roller means into said coating assembly;

e) means for independently actuating said coating carrier movement and said roller means movement;

f) means for independently adjusting pressure between said coating surface on said coating carrier and said workpiece on said impression cylinder and pressure between said roller means and said coating surface on said coating carrier; and

g) means for integrating said coating assembly with said impression cylinder in said operative position, such that a change in pressure between said carrying surface on said coating carrier and said workpiece on said impression cylinder, or actuation of said carrier into and out of contact with said workpiece, does not alter pressure between said roller and said coating carrier; and such that a change in pressure between said roller means and said carrying surface on said coating carrier, or actuation of said roller means into and out of contact with said coating surface on said coating carrier, does not alter pressure between said coating surface on said coating carrier and said workpiece on said impression cylinder.

3. The coating apparatus of claim 1 in which said coating assembly comprises:

a) support and retraction means for said coating assembly allowing movement of said coating assembly between at least three positions, a first position in which said coating surface on said coating carrier is operatively engaged with a workpiece on said press unit impression cylinder, a second (off-impression) position in which said coating surface on said coating carrier is separated somewhat from said workpiece on said press unit impression cylinder, and a third (storage) position in which said coating assembly is removed away from the impression cylinder, allowing access to said press; said coating assembly, including said means for metering and transferring coating material, remaining connected during movement of said coating carrier as part of said coating assembly.

4. The apparatus of claim 1, claim 2, or claim 3 wherein said impression cylinder is operatively associated with a printing blanket cylinder positioned in a printing unit of said printing press, whereby, in operation, a workpiece on said impression cylinder contacts said printing blanket at a first workpiece location while it contacts said coating surface on said coating carrier at a second workpiece location, enabling simultaneous printing and coating at said impression cylinder.

5. The apparatus of claim 1 wherein said coating assembly is mounted on an inclined support.

6. The apparatus of claim 1 further comprising a means for moving the coating assembly toward or away from the press unit.

7. The apparatus of claim 6 wherein the means for moving the coating assembly comprises a hydraulic cylinder.

8. The apparatus of claim 1 wherein said means for metering and transferring coating comprises a transfer cylinder in operative contact with said coating surface on said coating carrier and means for metering the amount of coating carried on said transfer cylinder.

9. The apparatus of claim 8 including means to control the nip between said transfer cylinder and said coating surface on said coating carrier.

10. The apparatus of claim 1 including a gear positively coupling said coating carrier to said impression cylinder when said coating assembly is in said first operating position.

11. The apparatus of claim 10 wherein said gear comprises a plastic material.

12. The apparatus of claim 1 wherein the impression cylinder comprises a gear adapted to drive a gear for the coating carrier.

13. The apparatus of claim 10 further comprising means of registering the gear for the coating carrier with the adjacent impression cylinder gear.

14. The apparatus of claim 13 further comprising sensors on said coating carrier gear and said impression cylinder gear to rotationally align said gears with one another.

15. The apparatus of claim 1 further comprising means for adjusting the position of the coating carrier relative to the impression cylinder, while the coating carrier remains drivingly engaged with the impression cylinder.

16. The apparatus of claim 8 or 9 comprising an adjustable stop to control the nip between the coating surface on said coating carrier and the workpiece on said impression cylinder, without changing the coating carrier relationship to the liquid coating metering and transfer means.

17. The apparatus of claim 1 wherein said coating carrier further comprises means for register adjustment with the adjacent press impression cylinder.

18. The apparatus of claim 17 wherein the register adjustment comprises a plurality of bolts corresponding to slots, which cooperate to allow for movement of the coating carrier with respect to a gear for the coating carrier.

19. The apparatus of claim 17 wherein the coating carrier further has means enabling lateral register adjustment relative to the adjacent press impression cylinder.

20. The apparatus of claim 19 wherein the lateral register adjustment means comprises threaded collars adapted to allow for lateral movement of the coating carrier located at both ends of said coating carrier relative to a shaft extending through and supporting the carrier, said shaft being fixed against lateral movement.

21. The apparatus of claim 1 wherein said impression cylinder is retrofit into a position in said printing press ordinarily occupied by a workpiece transfer cylinder.

22. The apparatus of claim 21 in which said position of said impression cylinder is retrofit in place of a workpiece transfer cylinder positioned to transfer said workpiece to a fixed coater.

23. The apparatus of claim 1 wherein said printing press is connected to a fixed coater and said impression cylinder is an impression cylinder that forms part of said coater.

24. The apparatus of claim 1 further comprising a means of locking the coating assembly to the press unit.

25. The apparatus of claim 24 wherein the means of locking comprises a clevis and a press-mounted lug cooperatively sized and positioned to engage said clevis, and a releasable latch pin adapted to connect said clevis to said lug.

26. The apparatus of claim 24 wherein the means of locking comprises a pair of cooperatively sized and positioned electromagnets.

27. The apparatus of claim 2 comprising

means to positively rotate said roller means,

means to positively rotate said coating surface on said coating carrier in registration with said workpiece supported and conveyed on said impression cylinder,

sequencing means, cooperatively associated with the means for actuating, for sequentially actuating movement of said roller to said coating surface on said coating carrier, before actuating movement of said coating surface on said coating carrier to engage said printed workpiece on said impression cylinder, and for sequentially actuating movement of said roller away from said coating surface on said coating carrier before actuating movement of said coating surface on said coating carrier away from said workpiece.

28. The apparatus of claim 1 comprising means to vary the surface speed of at least one roller in the roller means relative to the surface speed of the carrier.

29. The apparatus of claim 1, claim 2, or claim 3, wherein said coating carrier is a coating blanket cylinder or a coating plate cylinder.

30. The apparatus of claim 1, claim 2, or claim 3, wherein said coating carrier presents a gapped coating surface to said impression cylinder as said impression cylinder rotates, and said printing ink carrier presents a gapped printing surface to said impression cylinder as said impression cylinder rotates, said coating surface

(including said gap therein) having a perimeter substantially equal to the perimeter of said printing surface (including said gap therein).

31. The apparatus of claim 1, claim 2 or claim 3 wherein the coating carrier is a coating plate cylinder carrying a plate.

32. The apparatus of claim 1, claim 2 or claim 3 wherein the impression cylinder is a standardly supplied impression cylinder supporting a workpiece being printed on a lithographic printing press unit.

33. The apparatus of claim 1, claim 2, or claim 3, wherein the impression cylinder is retrofit in place of a standardly supplied transfer cylinder on a lithographic printing press unit.

34. The apparatus of claim 2 wherein means supporting and integrating comprises a first pair of frames supporting said moveable support means for said carrier and said roller means, including said support actuating means and adjustment means, where said pair is minutely adjustable, actuatable and relocatable to a remote position from said impression cylinder, said impression cylinder being supported by a second pair of frames.

35. The apparatus of claim 34 wherein said actuation means for said first pair of frames include a pair of hydraulic cylinders.

36. The apparatus of claim 2 wherein said means for independently adjusting pressure includes stops and screws for adjusting pressure between said coating surface on said coating carrier and said workpiece on said impression cylinder, associated with means to limit pressure therebetween.

37. The apparatus of claim 2 wherein the roller means comprises an engraved anilox roll having an engraved cell structure with a maximum capacity of approximately 15 billion cubic microns per square inch for carrying a water-base acrylic coating having a solids content of approximately 45% to apply a dry coat weight to said sheet workpiece of approximately 0.4 to 0.6 lbs/1000 Ft^2 when the anilox roll has a surface speed approximating that of the resilient coating surface of the coating carrier.

38. Apparatus for applying a uniform and smooth liquid coating, on line, to a printed workpiece in a multicolor sheet-fed lithographic printing press wherein coating is applied to said workpiece while said workpiece is supported and conveyed by an impression cylinder of said press, said coating being applied over wet ink, said apparatus comprising:

a coating carrier supporting a resilient coating surface in rotative pressure contact with said printed sheet workpieces;

roller means for metering and transferring a uniform predetermined quantity of coating to said resilient coating surface on said coating carrier;

coating supply means operatively associated with said roller means;

means supporting said coating carrier, said roller means and said coating supply means, into a cooperatively operable coating assembly;

means to adjust pressure between said resilient surface on said coating carrier and said sheet workpiece:

means to adjust pressure between said roller means and said coating carrier;

means to rotate said coating carrier such that said resilient surface of said carrier rotates with said sheet workpiece to apply a uniform, smooth coating over wet ink on said sheet workpiece:

means to rotate said roller means;

means to actuate said coating carrier from said sheet workpiece to an off-impression position;

support and guide means for said coating assembly attached to said press;

and, means to retract said coating assembly including said coating carrier, said roller means and said coating supply means, to a remote position substantially away from said impression cylinder, to provide access to said press upon movement of said coating apparatus.

39. A method for printing and coating a workpiece, by transmitting said workpiece through a coating apparatus in cooperation with an impression cylinder mounted on a lithographic printing press, said coating apparatus comprising

a) an independent, cooperatively operating coating assembly comprising:
   i) a liquid coating supply means;
   ii) a coating carrier which includes a resilient coating carrying surface for carrying liquid coating;
   iii) a means for metering and transferring liquid coating, operatively connected between said coating supply and said carrying surface, for maintaining a controlled amount of liquid coating on said coating carrying surface; and
   iv) structural members integrating said means for metering and transferring liquid coating and said coating carrier into said coating assembly;
b) supports for allowing movement of said coating assembly between: i) an operative position in which said coating surface on said carrying surface is in rotative pressure contact with a workpiece on said impression cylinder; and ii) a fully retracted position in which said coating assembly is completely disengaged from said impression cylinder at a location remote from the impression cylinder, said coating assembly, including said coating carrier and said means for metering and transferring coating material, remaining connected during said movement:

whereby, in said operative position, said carrying surface continuously delivers a smooth, uniform, metered amount of said liquid coating material to said workpiece on said impression cylinder.

40. The method of claim 39 in which said impression cylinder is operatively associated both with a printing carrier at a first location on said workpiece and with said coating carrier at a second location on said workpiece, to simultaneously print and coat said workpiece at a single impression cylinder.

41. The method of claim 39 in which said printing press includes a coater for providing a U.V. curable coating, and said coating assembly coats with a precoat, prior to application of said U.V. curable coating by said coater.

42. The method of claim 39 in which said printing press includes a fixed coater comprising a fixed coater impression cylinder operatively connected to a coater blanket cylinder and to said coating assembly carrier, whereby said method comprises coating said workpiece with two coating layers at said fixed coater impression cylinder.

43. A method for applying a liquid coating to a workpiece, using a coating apparatus operating on line with an impression cylinder of a lithographic printing press,

said press having at least one ink carrying surface for applying ink to said workpiece prior to coating. said coating apparatus comprising: a) a coating carrier adapted to carry a resilient coating surface in rotative pressure contact with said workpiece supported by said impression cylinder; b) a roller means for metering and transferring a uniform predetermined quantity of coating to said resilient coating surface on said coating carrier; c) coating supply means operatively associated with said roller means; d) a movable support for said coating carrier for moving said coating carrier into and out of contact with said workpiece on said impression cylinder; and a movable support for said roller means for moving said roller means into and out of contact with said coating surface on said coating carrier; said coating carrier and said roller means being integrated into a unitary assembly; said method comprising:

a) independently actuating said coating carrier movement on the one hand and said roller movement on the other hand;
b) independently adjusting pressure between said coating surface on said coating carrier and said workpiece on said impression cylinder and pressure between said roller means and said coating surface on said coating carrier; and
c) integrating said impression cylinder with said assembly, such that a change in pressure between said coating surface on said coating carrier and said workpiece on said impression cylinder, or actuation of said carrier into and out of contact with said workpiece, does not alter pressure between said roller means and said coating carrier; and such that a change in pressure between said roller means and said coating surface on said coating carrier, or actuation of said roller means into and out of contact with said coating surface on said coating carrier, does not alter pressure between said coating surface on said coating carrier and said workpiece on said impression cylinder.

44. The apparatus of claim **4**, wherein said coating carrier is a coating blanket cylinder or a coating plate cylinder.

45. The apparatus of claim **4**, wherein said coating carrier presents a gapped coating surface to said impression cylinder as said impression cylinder rotates, and said printing ink carrier presents a gapped printing surface to said impression cylinder as said impression cylinder rotates, said coating surface (including said gap therein) having a perimeter substantially equal to the perimeter of said printing surface (including said gap therein).

46. The apparatus of claim **4**, wherein the coating carrier is a coating plate cylinder carrying a plate.

47. The apparatus of claim **4**, wherein the impression cylinder is a standardly supplied impression cylinder supporting a workpiece being printed on a lithographic printing press unit.

48. The apparatus of claim **16** wherein said adjustable stop includes stops and screws for adjusting pressure between said coating surface on said coating carrier and said workpiece on said impression cylinder, associated with means to limit pressure therebetween.

49. Coating apparatus operating on line with an impression cylinder of a lithographic printing press to apply liquid coating to a workpiece, said press having at least one ink carrying surface for applying ink to said workpiece prior to coating, said coating apparatus comprising: a) a coating carrier adapted to carry a resilient coating surface in rotative pressure contact with said workpiece supported by said impression cylinder; b) a roller means for metering and transferring a uniform predetermined quantity of coating to said resilient coating surface on said coating carrier; c) coating supply means operatively associated with said roller means; d) a movable support for said coating carrier for moving said coating carrier into and out of contact with said workpiece on said impression cylinder; e) a movable support for said roller means for moving said roller means into and out of contact with said coating surface on said coating carrier; f) means for independently actuating said coating carrier movement on the one hand and said roller movement on the other hand; g) means for independently adjusting pressure between said coating surface on said coating carrier and said workpiece on said impression cylinder and pressure between said roller means and said coating surface on said coating carrier; h) means for integrating said impression cylinder with said assembly, such that a change in pressure between said coating surface on said coating carrier and said workpiece on said impression cylinder, or actuation of said carrier into and out of contact with said workpiece, does not alter pressure between said roller means and said coating carrier; and such that a change in pressure between said roller means and said coating surface on said coating carrier, or actuation of said roller means into and out contact with said coating surface on said coating carrier, does not alter pressure between said coating surface on said coating carrier and said workpiece on said impression cylinder;

said coating carrier and said roller means being integrated into a unitary assembly.

* * * * *

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United States Patent [19]

Williamson et al.

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[45] **Date of Patent: Dec. 6, 1994**

[54] **METALLIC COLOR PRINTING PROCESS**

[75] Inventors: **Jesse S. Williamson**, Dallas; **George V. Barnaby**, Irving; **Gary V. Doughty**, Dallas, all of Tex.

[73] Assignee: **Williamson Printing Corporation**, Dallas, Tex.

[21] Appl. No.: **887,510**

[22] Filed: **May 22, 1992**

[51] **Int. Cl.**^{5} **G03C 7/00**; G03C 5/00; G03F 9/00; H04N 1/21

[52] **U.S. Cl.** **430/358**; 430/359; 430/22; 430/30; 358/798; 358/534; 358/536

[58] **Field of Search** .... 430/358, 359, 30, 293, 430/301, 21, 143, 43, 44, 347; 106/19 R; 358/75, 80, 534, 536, 298

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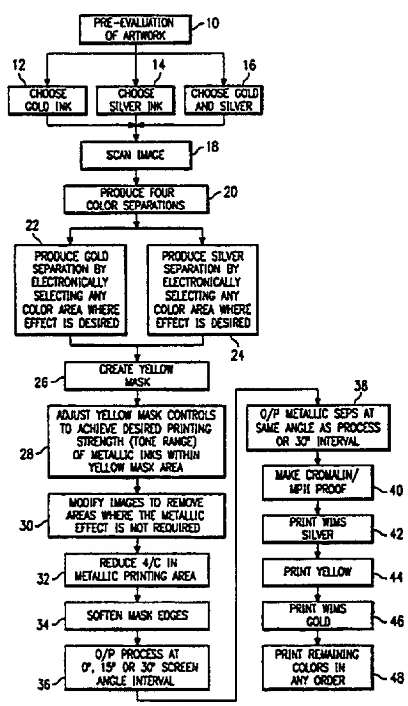
Primary Examiner—Charles L. Bowers, Jr.
Assistant Examiner—J. Pasterczyk
Attorney, Agent, or Firm—Jones, Day, Reavis & Pogue

[57] **ABSTRACT**

A method of reproducing on a substrate an image incorporating metallic inks involves scanning (**18**) the image to be reproduced and creating (**20**) four color separations of the scanned image. Metallic gold and/or metallic silver color separations (**22, 24**) are created by electronically selecting any color area where the effect is desired. Next, the color separations are edited by creating (**26**) an electronic yellow mask of the image and adjusting (**28**) the desired tonal range of the metallic areas. The mask edges of each color separation can also be softened (**34**). The scanner then outputs (**36, 38**) the separations to film. The image is then reproduced by printing each of the process color separation films (**44, 48**) and the metallic separation films (**42, 46**) onto a substrate.

12 Claims, 2 Drawing Sheets



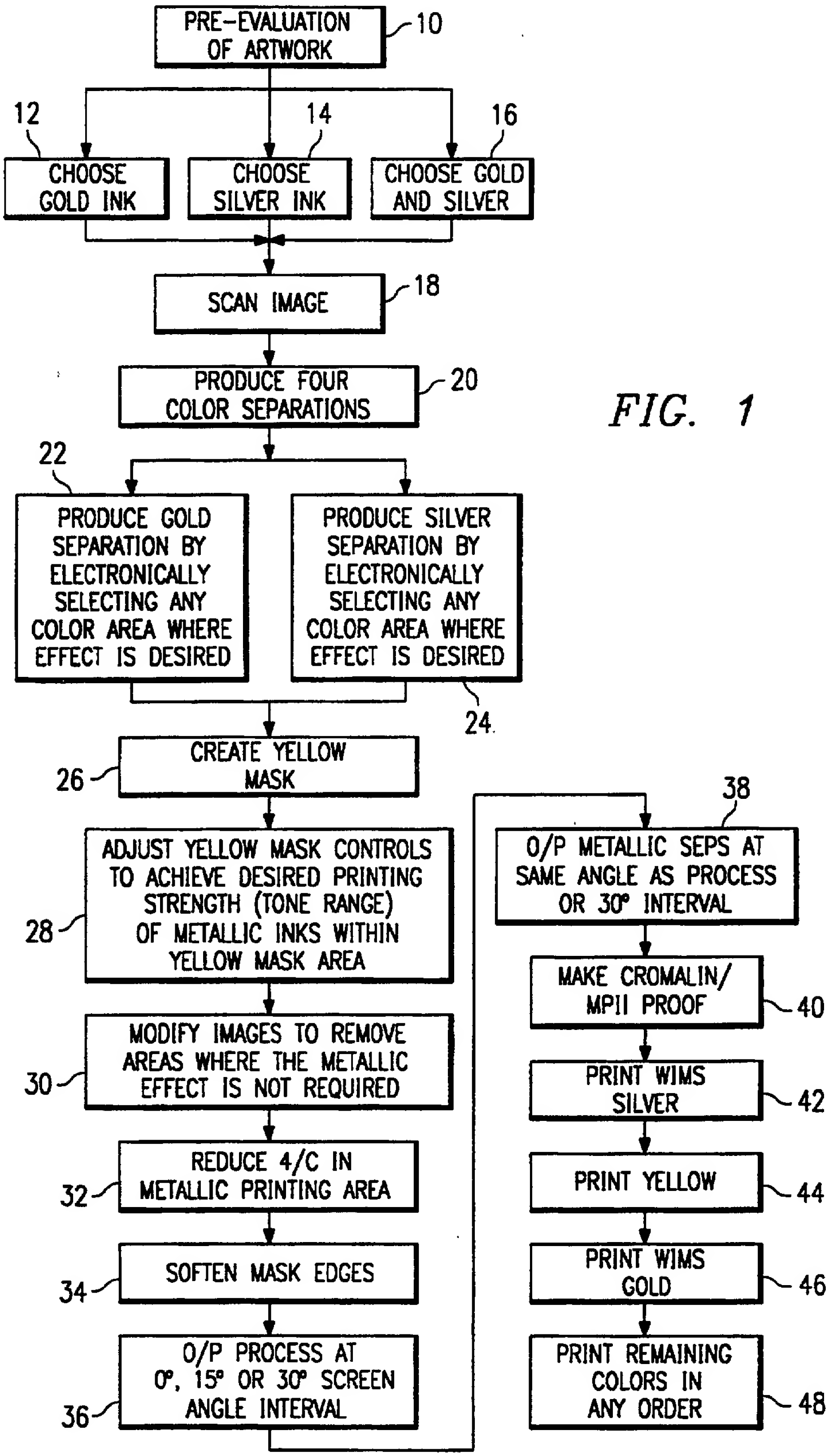

PRE-EVALUATION OF ARTWORK
10
12
14
16
CHOOSE GOLD INK
CHOOSE SILVER INK
CHOOSE GOLD AND SILVER
SCAN IMAGE
18
PRODUCE FOUR COLOR SEPARATIONS
20
22
PRODUCE GOLD SEPARATION BY ELECTRONICALLY SELECTING ANY COLOR AREA WHERE EFFECT IS DESIRED
PRODUCE SILVER SEPARATION BY ELECTRONICALLY SELECTING ANY COLOR AREA WHERE EFFECT IS DESIRED
24
CREATE YELLOW MASK
26
ADJUST YELLOW MASK CONTROLS TO ACHIEVE DESIRED PRINTING STRENGTH (TONE RANGE) OF METALLIC INKS WITHIN YELLOW MASK AREA
28
MODIFY IMAGES TO REMOVE AREAS WHERE THE METALLIC EFFECT IS NOT REQUIRED
30
REDUCE 4/C IN METALLIC PRINTING AREA
32
SOFTEN MASK EDGES
34
O/P PROCESS AT 0°, 15° OR 30° SCREEN ANGLE INTERVAL
36
38
O/P METALLIC SEPS AT SAME ANGLE AS PROCESS OR 30° INTERVAL
MAKE CROMALIN/ MPII PROOF
40
PRINT WIMS SILVER
42
PRINT YELLOW
44
PRINT WIMS GOLD
46
PRINT REMAINING COLORS IN ANY ORDER
48

FIG. 1

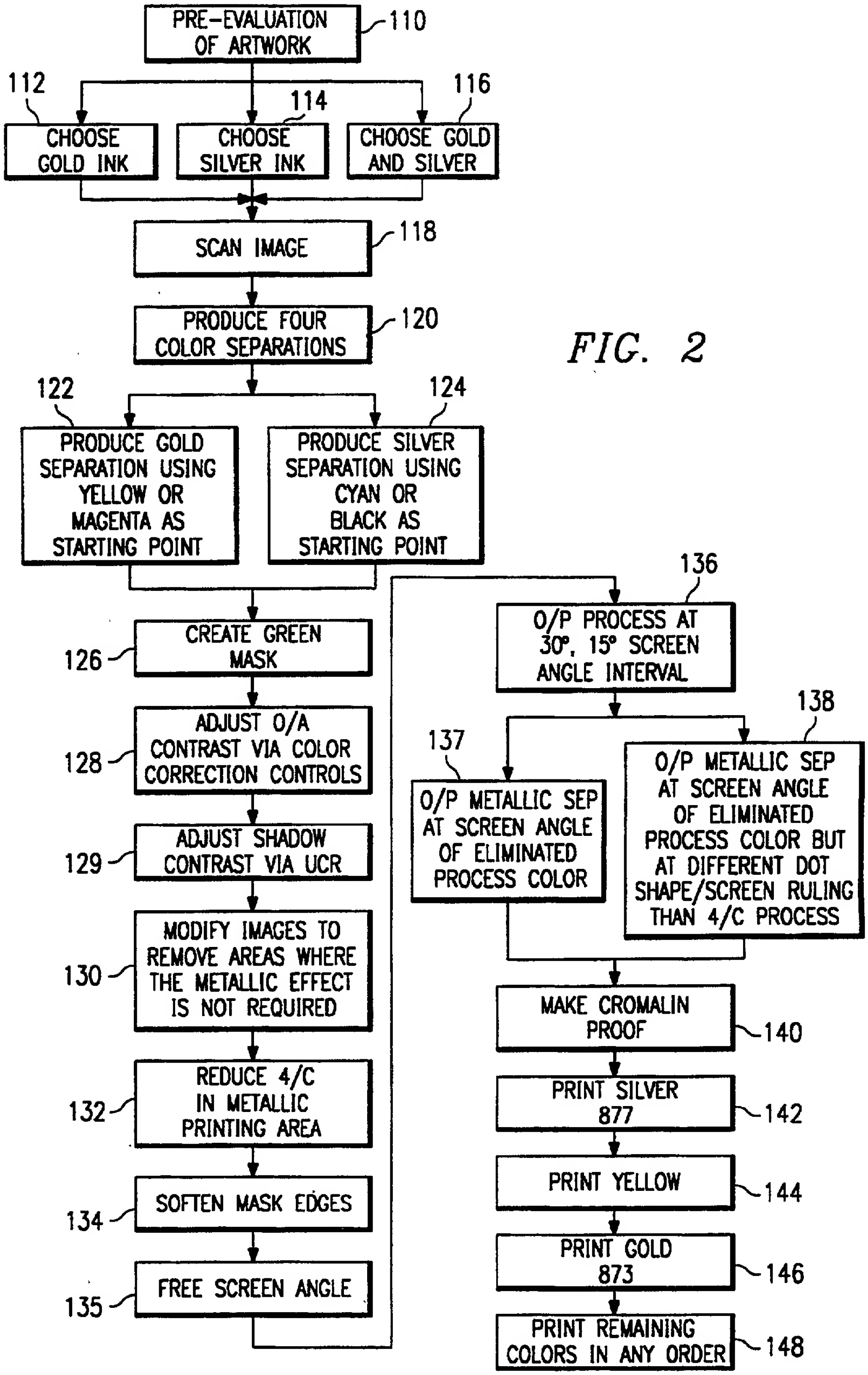

PRE-EVALUATION OF ARTWORK
110
112
CHOOSE GOLD INK
114
CHOOSE SILVER INK
116
CHOOSE GOLD AND SILVER
SCAN IMAGE
118
PRODUCE FOUR COLOR SEPARATIONS
120
122
PRODUCE GOLD SEPARATION USING YELLOW OR MAGENTA AS STARTING POINT
124
PRODUCE SILVER SEPARATION USING CYAN OR BLACK AS STARTING POINT
126
CREATE GREEN MASK
128
ADJUST O/A CONTRAST VIA COLOR CORRECTION CONTROLS
129
ADJUST SHADOW CONTRAST VIA UCR
130
MODIFY IMAGES TO REMOVE AREAS WHERE THE METALLIC EFFECT IS NOT REQUIRED
132
REDUCE 4/C IN METALLIC PRINTING AREA
134
SOFTEN MASK EDGES
135
FREE SCREEN ANGLE
136
O/P PROCESS AT 30°, 15° SCREEN ANGLE INTERVAL
137
O/P METALLIC SEP AT SCREEN ANGLE OF ELIMINATED PROCESS COLOR
138
O/P METALLIC SEP AT SCREEN ANGLE OF ELIMINATED PROCESS COLOR BUT AT DIFFERENT DOT SHAPE/SCREEN RULING THAN 4/C PROCESS
MAKE CROMALIN PROOF
140
PRINT SILVER 877
142
PRINT YELLOW
144
PRINT GOLD 873
146
PRINT REMAINING COLORS IN ANY ORDER
148

FIG. 2

METALLIC COLOR PRINTING PROCESS

TECHNICAL FIELD OF THE INVENTION

The present invention relates to a metallic color printing process. Specifically, this method produces an improved metallic image by printing the subtractive primary colors, black, metallic gold and/or metallic silver at four screen angles.

BACKGROUND OF THE INVENTION

The reproduction of color was first achieved by Scottish physicist James Maxwell in the mid 1850's. Maxwell photographed a scene three times, once through a red filter, once through a green filter, and once through a blue filter. These black-and-white negatives were contacted to produce positives that were then mounted as slides. Each slide was placed in a different projector and the images were focused together on a screen. A red, green, or blue filter was placed over the lens of each respective projector, thus producing a color image on the screen.

The first single film image for color photography was produced by Louis Ducos du Huron in France in the late 1860's. In his system, the image on a black-and-white panchromatic emulsion was broken up by a series of red, green, and blue transparent dots or lines that formed a screen in front of the emulsion. The dots and lines were so small that they could not be resolved by the eye. After exposure, the film was reversal-processed to yield a colored positive transparency. The additive-color transparency is still used by the Polaroid Corporation with their 35-ram Polachrome slide process.

The development of the subtractive color systems was also pioneered by du Huron. He suggested making separation negatives through red, green, and blue filters, then making positive transparencies from each, dyeing them with colors that absorb each respective primary color (i.e. cyan, magenta, and yellow). This subtractive method is difficult to use because it requires the accurate registration of the colored positives or the accurate registration of images from dyed positive matrices. The solution was a three-emulsion film, each layer made sensitive to a different color (red, green, or blue) and then dyed a different color (cyan, magenta, or yellow) in processing. The first successful film of this type was Kodachrome, introduced by the Eastman Kodak Company in 1935.

Printed color reproduction is based on many of the same principles as film color reproduction. Instead of a continuous image, allowed by the film medium, a series of dots are printed on a substrate. These dots are printed in the subtractive primary colors of cyan, magenta, and yellow. Additionally, black is used to adjust the contrast of the image. In the subtractive process, a white substrate is used and red, green, and blue are essentially subtracted to achieve black. By contrast, in the additive system, a black background (i.e. a blank TV screen) is used, and red, green, and blue are added to achieve white. In the additive system the following combinations create the following results:

Red+Green=Yellow
Red+Blue=Magenta
Green+Blue=Cyan
Red+Green+Blue=White

In the subtractive process, the following is true:

White+Yellow+Cyan=Green

White+Magenta+Cyan=Blue
White+Magenta+Yellow=Red
White+Yellow+Magenta+Cyan=Black

Moreover, each subtractive primary color when added with white produces that same subtractive primary color.

The objective in printing is to produce yellow, magenta, and cyan printing plates that are negative records of the amounts of blue, green, and red in the original. This is achieved by first photographing the original, in turn, through blue, green, and red filters. These films may then be converted into a halftone dot image suitable for a given printing process. The films are then used to make the image carriers, which may be plates, cylinders, or stencils. Each plate is inked with its appropriate ink, which is then transferred to a white substrate.

The image produced is largely dependant upon dot size and orientation. Orientation is defined primarily by the screen angle of the dot. The screen angle is the angle at which the rulings of a halftone screen are set when making screened images. In other words, the screen angle of a dot is the angle of the line which bisects the often elliptical dots. Standard screen angles have been established for various colors of dots: Magenta (45°), Cyan (75°), Yellow (90°), Black (105°). The interaction of screen angle, color, and dot size effect the quality of the reproduction.

Printing metallic colors, such as metallic gold and metallic silver, poses additional problems. Gold has typically been treated as a shade of yellow, while silver has been treated as a shade of gray. Thus the brilliance of these colors is diminished by the blending of hues which occurs in a four color printing system.

A system known as Metallic Integrated Printing Process (MIPP) has been developed for the reproduction of metallic colors by Eckart-Werke Metal Pigments and Powders of Furth, Bayern, Germany. This system requires numerous steps. First, a designer marks-up the artwork to be copied to designate those areas where the MIPP system is required, i.e. metallic colored areas. Next, a conventional four color separation is produced of the artwork. Each separation is then compared to the original artwork to see which separation gives the best representation of the metallic colors. Based on the object color in the original photograph and the color requirements of the final print, a determination is then made whether gold or silver is required. Most shades of gold can be obtained from silver and yellow. However, a high percentage of yellow on silver greatly reduces the metallic brilliance. In addition, silver has a grey value of approximately 30% that tends also to reduce the metallic brilliance and thereby dirty colors.

After the four color separations are made, two separations used to print the metallic inks must be developed from two of the four separations. Typically the cyan or black separation will give the best basis for developing the silver separation and either the yellow or magenta for the gold separation. The selected separations are then duplicated to become the gold and silver separations. These separations may require modification to remove image areas where a metallic effect is not required. Comparison with the original transparency may indicate the need to enhance some image areas so as to improve the final metallic effect. The MIPP system anticipates the softening of mask edges of the metallic colors to avoid sharp cut-out effects when the final result is printed. In practice, the task of softening of

mask edges can be handled using electronic image processing equipment.

With the MIPP systemic, a screen angle must be freed for each of the metallic inks to avoid problems of screen clash and resulting moire effects. This can be accomplished by using achromatic or Under Color Removal, ("UCR") color separation techniques where the process color with the lowest value is eliminated in favor of black. UCR involves the technique of reducing the cyan, magenta, and yellow content in neutral grey shadow areas of a reproduction and replacing them with black ink so that the reproduction will appear normal but will use less process color ink. (From the Complete Color Glossary by Miles Southworth, Thad McIlroy and Donna Southworth, Copyright 1992; Published by The Color Resource, Livonia, N.Y. ISBN 1-879847-01-9). Often the cyan will have the lowest value and is the color to eliminate. Since both gold and silver have a process color value, the four conventional separations will need to be modified if the finished print is not to look over-colored or dirty. For example PANTONE 873, the MIPP gold standard, has a process color value of approximately 65% yellow, 25% magenta and 5% cyan. So if the gold areas are to look realistic these colors must be reduced proportionately. The separations may also require modification as the metallic inks have a grey scale value and a failure to take this into account may result in a dirtying of the final colors due to a reduction in their metallic brilliance.

A MIPP image is printed using standard screen angle intervals of 30° or 15°. The screen angle used for a metallic ink is the same as that for the process colors eliminated in favor of a metallic ink. The MIPP system may use different dot shapes to reduce the risk of screen clash. A round dot, with no preferred direction, is typically used for the metallic ink, while an elliptical dot works for the standard process inks. The color standards chosen for MIPP come from the PANTONE System of matched metallic inks, with PANTONE 873 as the gold standard and PANTONE 877 as the silver standard.

Because metallic inks are opaque, they are normally printed before the transparent process colors. But with MIPP the sequence is changed slightly so that the first three colors down are silver, yellow, and gold, respectively. The remaining three process colors are printed in any order. The first three colors, in this order, are very important if the finished print is to look realistic. The use of yellow on silver is necessary to obtain yellow, green and orange metallic effects. Yellow, under gold, is also necessary to maintain the correct tonal values in the highlight areas. Yellow, printed in this way, provides a transition from gold to non-metallic pans of the image. On the other hand, if yellow is printed on top of the gold, there is a loss of metallic sheen without any compensating color benefit.

In summary, the MIPP system presents several disadvantages. First, it requires excessive handwork to create the color mash. Second, the MIPP system requires the elimination of one of the subtractive process colors to free up a screen angle for a metallic color. Third, the MIPP system only allows the printing of four screened colors in any given area. Last, the PMS 873 standard gold ink used by the MIPP system is a dirty, or less brilliant gold ink. This dirty look limits the gold color reproduction to the inherent dirty look even if no other color ink is printed in that area. This dirty look also necessitates additional color correction of the sub tractive primaries. Therefore, a need exists for a printing process which maximizes the appearance of metallic colors. Such a process should allow the use of six colors printed at four screen angles. Moreover, such a process should not limit the number of colors in any given area to four as with the MIPP System.

SUMMARY OF THE INVENTION

The present invention relates to the Williamson Integrated Metallic System (WIMS) developed to allow six color printing using yellow, magenta, cyan, black, metallic silver, and/or metallic gold. The WIMS System creates a realistic metallic gold or metallic silver effect using the subtractive primary colors, black, silver and/or gold. The WIMS method comprises a number of steps. The subject to be reproduced is first scanned by a standard scanner and four color separations are created. The original art is then edited to achieve the required metallic effect. Editing comprises the steps of creating a yellow mask, reviewing an electronic version of the image produced by the scanner, determining the amount of contrast between heavy and light metallic regions on the image by one skilled in the art based on past experience, and then sending that contrast information back to the scanner. A "yellow mask" is created to isolate areas where a metallic effect is desired. This "yellow mask" allows the operator to select these areas based on the color and tonal region of the original. For example, those areas appearing neutral are appropriate for silver metallic, while those areas appearing high yellow with a red component are appropriate for the gold metallic. Additional modification of dot size in these isolated areas may be required to avoid moire and reduction in metallic brilliance of the final colors. These colors can be printed at four screen angles: cyan (75°), magenta (45°), silver (45°), gold (75°), yellow (90°), and black (105°).

In the WIMS System, a cleaner, or more brilliant gold color ink is used, wherein the process color value is less than 25% for magenta and less than 5% for cyan. This should diminish any dirtiness caused by the process color values of adjacent primary colors. Additionally, any harsh edge effects caused during printing may be softened during the electronic masking stage. During printing, the silver separation can be printed at the same screen angle as the magenta, while the gold separation can be printed at the same screen angle as the cyan separation.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the present invention, and for further details and advantages thereof, reference is now made to the following Detailed Description taken in conjunction with the accompanying drawings, in which:

FIG. 1 illustrates a flow chart of the WIMS System for reproduction of metallic color; and

FIG. 2 illustrates a flow chart of the prior art MIPP System.

DETAILED DESCRIPTION OF THE DRAWINGS

The present invention relates to a metallic color printing process, also known as the WIMS System, that overcomes many of the disadvantages found in the prior art. Referring to FIG. 1, a flow chart illustrates the steps involved in the present method.

A first step involves pre-evaluation at step 10 of the subject to determine desired effects and proper placement of metallics in process reproduction. Metallic gold can be chosen at step 12, metallic silver can be chosen at step 14, or a combination of both metallic gold and metallic silver can be chosen at step 16. Next, the image can be scanned at step 18 by a scanner which, in turn, produces at step 20 four color separations which are electronically viewed on the scanner display. The scanner acts as both an input device and an output device. In other words, the artwork is input to the scanner. The scanner can then output color separations or film used to recreate the artwork. The scanning step involves the application of 75% to 100% to the scanner set-up and the scanning of the image. Then, the PCR is removed from the scanner set-up and the image is scanned to an "Imagedit", an electronic color correction machine, produced by the Crosfield Co. of Hemel Hempstead, England.

The original artwork is evaluated in a well known manner by one skilled in the art to determine the color areas in which the metallic effect is desired. A gold separation can be produced at step 22 by electronically selecting any color area where the effect is desired. Likewise, a silver separation can be produced at step 24 by electronically selecting any color area where the effect is desired. Typically, the cyan or black areas of the original art will be the basis for developing the silver printing whereas yellow or magenta areas of the original art will form the starting point for creating the gold printing. It is emphasized that either the gold or silver separations may be produced by selecting any color area where the effect is desired.

Using the Crosfield Imagedit, a "yellow mask" can then be created at step 26 to isolate the areas where a metallic effect is desired from the rest of the separation. The "yellow mask" function gives the ability to select the desired areas electronically based on the tonal region or bandwidth of the original as well as the desired color region. Creating a yellow mask entails several steps. First, an electronic version of the image produced by the scanner displays the contrast between a heavy metallic region and a light metallic region on the image. For example, neutrals are appropriate for silver, while high yellows with a red component are appropriate for gold. The yellow mask controls can be adjusted at step 28 to achieve desired printing strength (tonal range) of metallic inks within the yellow mask area. These controls allow the adjustment of slope, gain, and rolloff of the image within the yellow mask area.

Next, the Imagedit computer creates six revised color separations in a well-known manner; one each for yellow, cyan, magenta, black, gold and silver. Once these electronic masks are created, further modification at step 30 of the isolated area may be required. For example, such modifications may increase or reduce the printing dot size of the metallic separation and/or adjust at step 32 the amount of four color process ink printing over the newly created metallic to compensate for the reduction in brilliance caused by the additional metallic color in the reproduction. Additionally, in a given original, there may be areas of similar color where a metallic effect is desired in one area but not the other. For example, a gold watch requires a, metallic gold, while a golden retriever would not. Due to this anomaly, further electronic manipulation of the image may be required to eliminate metallic ink in unwanted areas. Moreover, because all masking is performed electronically, it is possible to soften at step 34 any harsh edge effects in the final reproduction via mask smoothing or tonal integration techniques.

Next, this information is sent back to the scanner which outputs at step 36 the subtractive process colors and the metallic separations. The MIPP standard for screening is to eliminate (by hand masking) one of the process colors in metallic areas to free-up a screen angle, or to produce the metallic separations at a line screen resolution different than the process colors to reduce moire effects. However, in the WIMS process, the subtractive process colors are output at step 36 at 0°, 15°, and/or 30° screen angle intervals. An interval is the spacing between any two screen angles. The metallic color separations are output at step 38 at the same angles as the subtractive process colors or at 30° intervals. The gold separation can be produced at the same screen angle as the cyan separation. Likewise, the silver separation can be produced at the same angle as the magenta separation. Therefore, with WIMS reproductions, six colors can be printed at four screen angles. For example, cyan can be printed at 75°, magenta at 45°, silver at 45°, gold at 75°, yellow at 90°, and black at 105°. Both process and metallic separations are produced at the same line screen resolution. Typically, there are no problems with moire effect.

The next step involves metallic inks: a gold ink, a silver ink, or both gold and silver. The Pantone MIPP standard for gold ink is PMS 873. This ink printed solid has a process color value of approximately 65% yellow, 25% magenta and 5% cyan. For WIMS reproduction, however, a much more brilliant gold ink is used, wherein the magenta and cyan process equivalents are greatly reduced. This was selected under the rationale that a pure gold ink area of WIMS gold could be reduced in brilliance, but a pure PMS 873 ink area could not be made any more brilliant than the inherent bronze color of the ink. This same color compensation theory also applies to silver areas where a calculated reduction in cyan or black generally occurs.

Prepress proofing at step 40 is accomplished via a combination of 3M Matchprint II (for process colors) and Dupont Cromalin (for metallics). After proofing, the artwork is reproduced by first printing at step 42 the WIMS standard for silver, then printing at step 44 yellow, then printing at step 46 the WIMS standard for gold, and finally printing at step 48 the remaining subtractive primary colors in any order.

FIG. 2 provides a flow chart of the MIPP process which is discussed in greater detail in the Background Section. In sum, the designer marks up the artwork to be reproduced to show where MIPP is required and the image is scanned at step 118. Based on the object color in the original photograph and the color requirements of the final print, a determination is then made whether to choose at step 112 gold, choose at step 114 silver, or to choose at step 116 both silver and gold. The artwork is then scanned at step 118 by a scanner and a standard four-color separation is produced at step 120. Each separation is compared to the original to determine which gives the best representation of the metallic colors. A gold separation is next produced at step 122 using the screen angle of the process color that was eliminated in that area, as will be discussed in greater detail. Likewise, a silver separation can also be produced at step 124 using the screen angle of the process color that was eliminated in that area.

A green mask is created at step **126** with the scanner and viewed on the scanner display. The overall contrast of the green mask can be adjusted at step **128** via the color correction controls. Shadow contrast can then be adjusted via undercolor removal (UCR). Next, the image is modified at step **130** to remove areas where the metallic effect is not required. The level of the four subtractive process colors can be reduced at step **132** in the metallic printing area. Mask edges can then be softened at step **134**.

Next, a screen angle must be freed at step **135** for each of the metallic inks to avoid problems of screen clash and resulting moire effects. In other words, in any one area where a metallic ink is used, the subtractive primary color with the same screen angle must be eliminated or made solid. Thus, no more than four screened colors may appear in any one area of the reproduction. The scanner outputs at step **136** the subtractive process colors to film at 30° and 15° intervals. The scanner can then output at step **137** the metallic separations at a screen angle of an eliminated process color. Alternatively, the scanner can output at step **138** the metallic separations at the screen angle of the eliminated process color but at a different dot shape and/or screen ruling than the four subtractive process colors. Prepress proofing at step **140** is accomplished. After proofing, the artwork is reproduced by first printing at step **142** the PMS 877 standard for silver, then printing at step **144** yellow, then printing at step **146** the PMS 873 standard for gold, and finally printing at step **148** the subtractive primary colors in any order.

Although preferred embodiments of the invention have been described in the foregoing Detailed Description and illustrated in the accompanying drawings, it will be understood that the invention is not limited to the embodiments disclosed, but is capable of numerous rearrangements, modifications, and substitutions of parts and elements without departing from the spirit of the invention. Accordingly, the present invention is intended to encompass such rearrangements, modifications, and substitutions of parts and elements as fall within the scope of the invention.

We claim:

1. In a method of half-tone dot printing a reproduction of a scanned image on a substrate with the four subtractive process colors of magenta, cyan, yellow, and black in a given area of the scanned image at only four screen angles, an improved method of incorporating metallic colors in said reproduction, the improvement comprising the steps of:

printing at least one metallic color in said given area at a selected one of the only four screen angles; and

printing at least one of said four subtractive process colors in said given area at the same screen angle as said at least one metallic color such that said at least one metallic color and one process color are printed in said given area at the same one of said four screen angles so as to enable at least five colors to be printed at only said four screen angles.

2. A method as in claim 1 further including the steps of:

printing a second metallic color in said given area at a second one of said four screen angles; and

printing a second one of said four subtractive process colors in said given area at the same second one of said four screen angles as said second metallic color so as to have an additional metallic color and an additional process color printed in said given area at said second one of said four screen angles so that up to six colors are printed at only said four screen angles.

3. The method of claim **1** of reproducing a scanned image on a substrate including incorporating metallic colors and further comprising the steps of:

producing four process color separations of the scanned image, each at one of said four screen angles;

producing at least one metallic color separation at the same screen angle as a corresponding first one of the four screen angles of the process color separations in said given area;

editing each process color separation and the at least one metallic color separation to obtain metallic color separation information;

outputting each process color separation to film creating a process color separation film;

outputting the at least one metallic color separation to film creating a first metallic color separation film; and

printing a reproduction of the scanned image on a substrate using the process color separation films and the at least one metallic color separation film such that both a metallic color separation and a process color separation are produced at the same screen angle.

4. The method of claim **3** of reproducing a scanned image on a substrate including metallic colors anti further comprising the steps of:

producing a second metallic color separation at the same screen angle as a corresponding second one of the four screen angles of the process color separations in said given area;

editing the second metallic color separation to obtain metallic color separation information;

outputting the second metallic color separation to film creating a second metallic color separation film; and

printing a reproduction of the scanned image on a substrate using the process color separation film and the first and second metallic color separation films such that said first metallic color separation and a first process color separation are produced at an identical first screen angle and the second metallic color separation and second process color separation are produced at a second identical screen angle so as to enable up to six colors to be printed in the given area in only four screen angles.

5. The method of claim **4** wherein the step of producing a first and a second metallic color separation further comprises the steps of:

producing a gold metallic color separation as the first metallic color separation; and

producing a silver metallic color separation as the second metallic color separation.

6. The method of claim **4** wherein the step of producing a first and a second metallic color separation further comprises the steps of:

producing a silver metallic color separation as the first metallic color separation; and

producing a gold metallic color separation as the second metallic color separation.

7. The method of claim **4** wherein the step of editing further comprises the steps of:

reviewing an electronic version of the scanned image to determine regions of the image where metallic color is to be added;

creating a yellow mask for the given area to enable isolation of any region therein where metallic color is to be printed;

electronically adjusting the amount of contrast between the isolated regions to achieve a desired metallic color contrast between said isolated regions so as to obtain metallic color separation information; and

sending the metallic color separation information back to the scanner to provide half-tone dot signals.

8. The method of claim 4 wherein the step of outputting the at least one metallic color separation further comprises the step of outputting the first metallic color separation at the same screen angle as a first process color separation or at a 0°, 15°, or 30° interval therefrom.

9. The method of claim 4 wherein the step of outputting the second metallic color separation further comprises the step of outputting the second metallic color separation at the same screen angle as a second process color separation or at a 0°, 15°, or 30° interval therefrom.

10. The method of claim 3 wherein the step of editing further comprises softening an image edge of the process color separations and metallic color separations.

11. The method of claim 3 wherein the step of outputting the process color separations comprises outputting the process color separations onto film at 0°, 15°, or 30° screen angle intervals.

12. The method of claim 1 wherein the step of printing comprises:

(a) printing the metallic silver onto the substrate;

(b) printing yellow onto the substrate;

(c) printing the metallic gold onto the substrate;

(d) printing the remaining colors onto the substrate in any order.

* * * * *

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US005176077A

United States Patent [19]

DeMoore et al.

[11] **Patent Number:** **5,176,077**

[45] **Date of Patent:** **Jan. 5, 1993**

[54] **COATING APPARATUS FOR SHEET-FED, OFFSET ROTARY PRINTING PRESSES**

[75] Inventors: **Howard W. DeMoore**, 2552 Royal La., Dallas, Tex. 75229; **David D. Douglas**, Garland; **Steven M. Person**, Seagoville, both of Tex.

[73] Assignee: **Howard W. DeMoore**, Dallas, Tex.

[21] Appl. No.: **752,778**

[22] Filed: **Aug. 30, 1991**

[51] **Int. Cl.**[5] **B41F 9/00**

[52] **U.S. Cl.** **101/142**; 101/147; 101/232; 101/348; 118/46

[58] **Field of Search** .... 101/135, 424.1, 142, 101/148, 155, 157, 177, 217, 232, 246, 329, 330, 331, 408, 409, 419, 422, 348-349; 118/46, 211, 236, 249, 257, 258, 261, 262, 263, 206, DIG. 15

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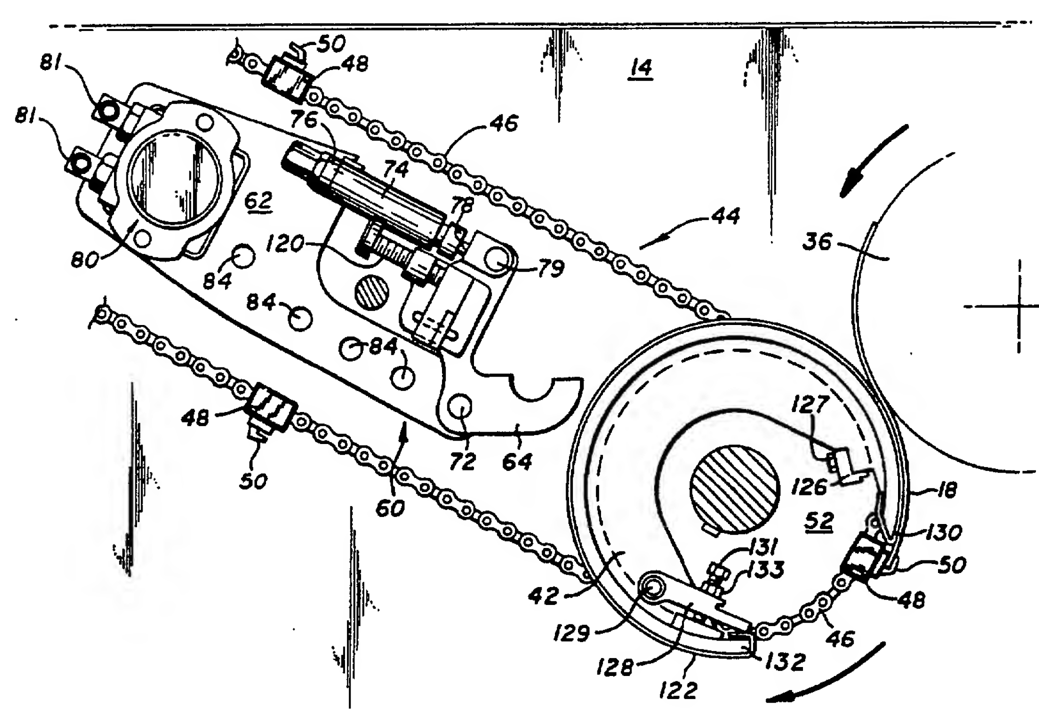
Primary Examiner—Eugene H. Eickholt
Attorney, Agent, or Firm—Dennis T. Griggs

[57] **ABSTRACT**

A coating apparatus for use in a sheet-fed, offset rotary printing press to selectively apply a protective and/or decorative coating to the wet ink surface of freshly printed sheets and including a coating unit having a pick-up roller for supplying aqueous coating material from a reservoir to the surface of a delivery cylinder mounted on a press delivery drive shaft, the delivery cylinder performing the dual function of a coating applicator roller and a delivery cylinder during coating operations.

22 Claims, 5 Drawing Sheets



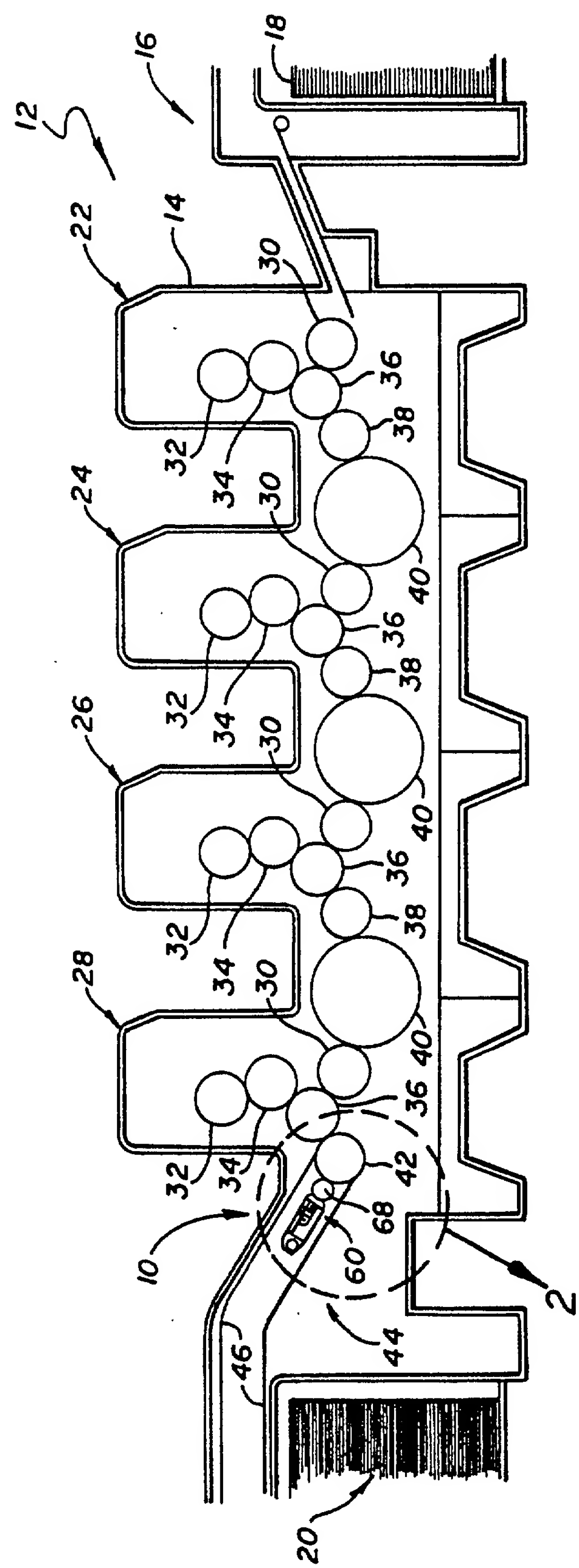


FIG. 1

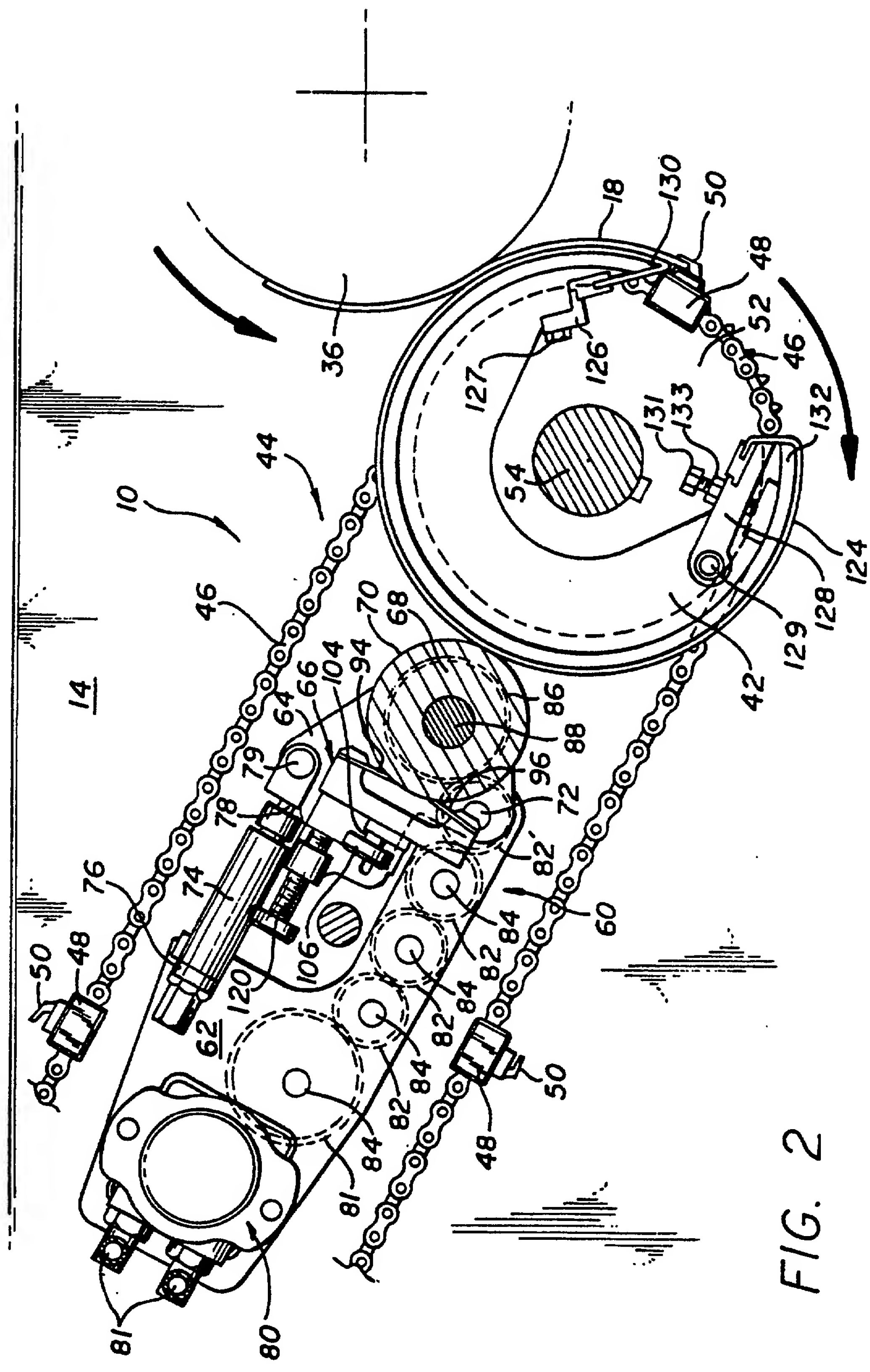


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FIG. 2

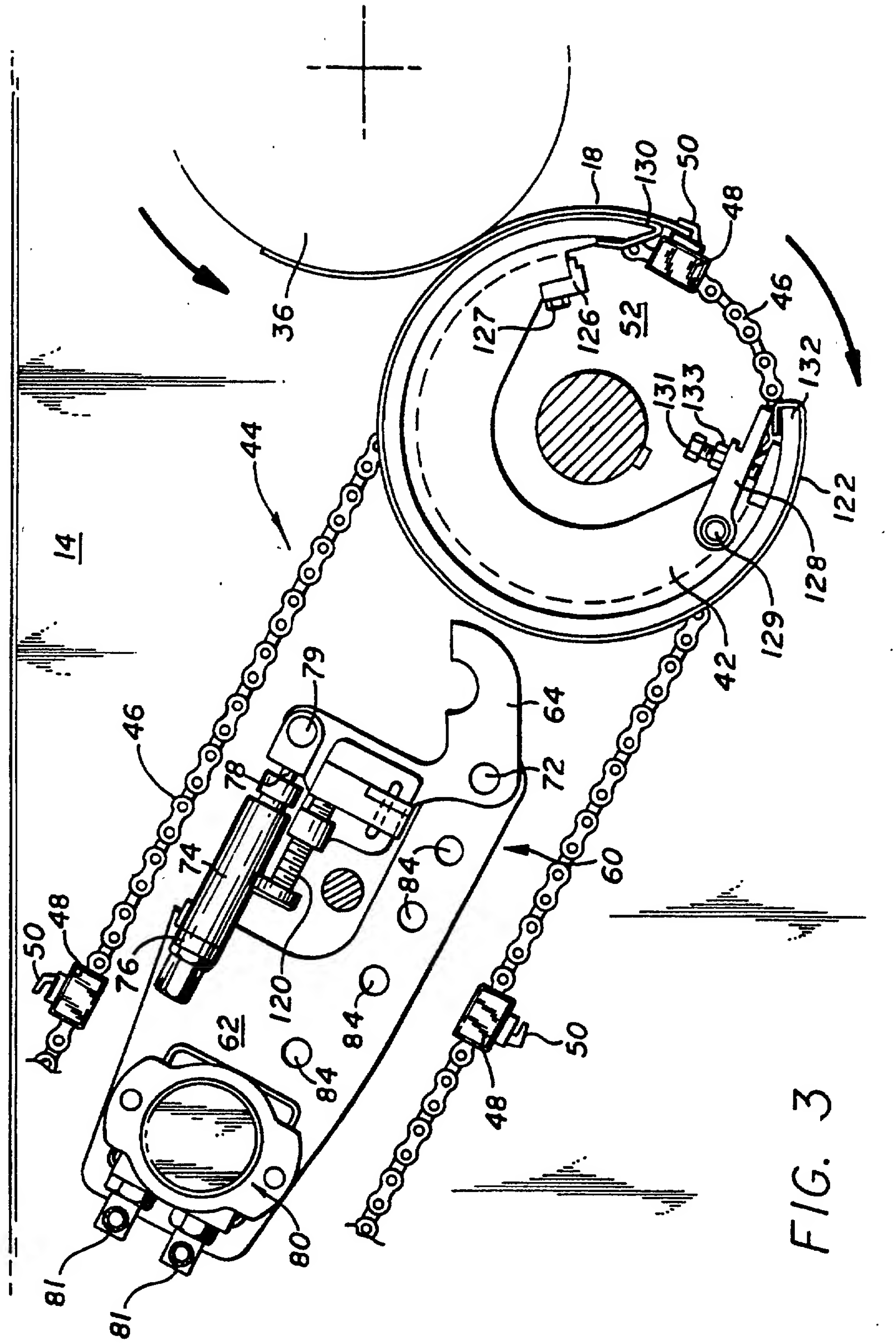
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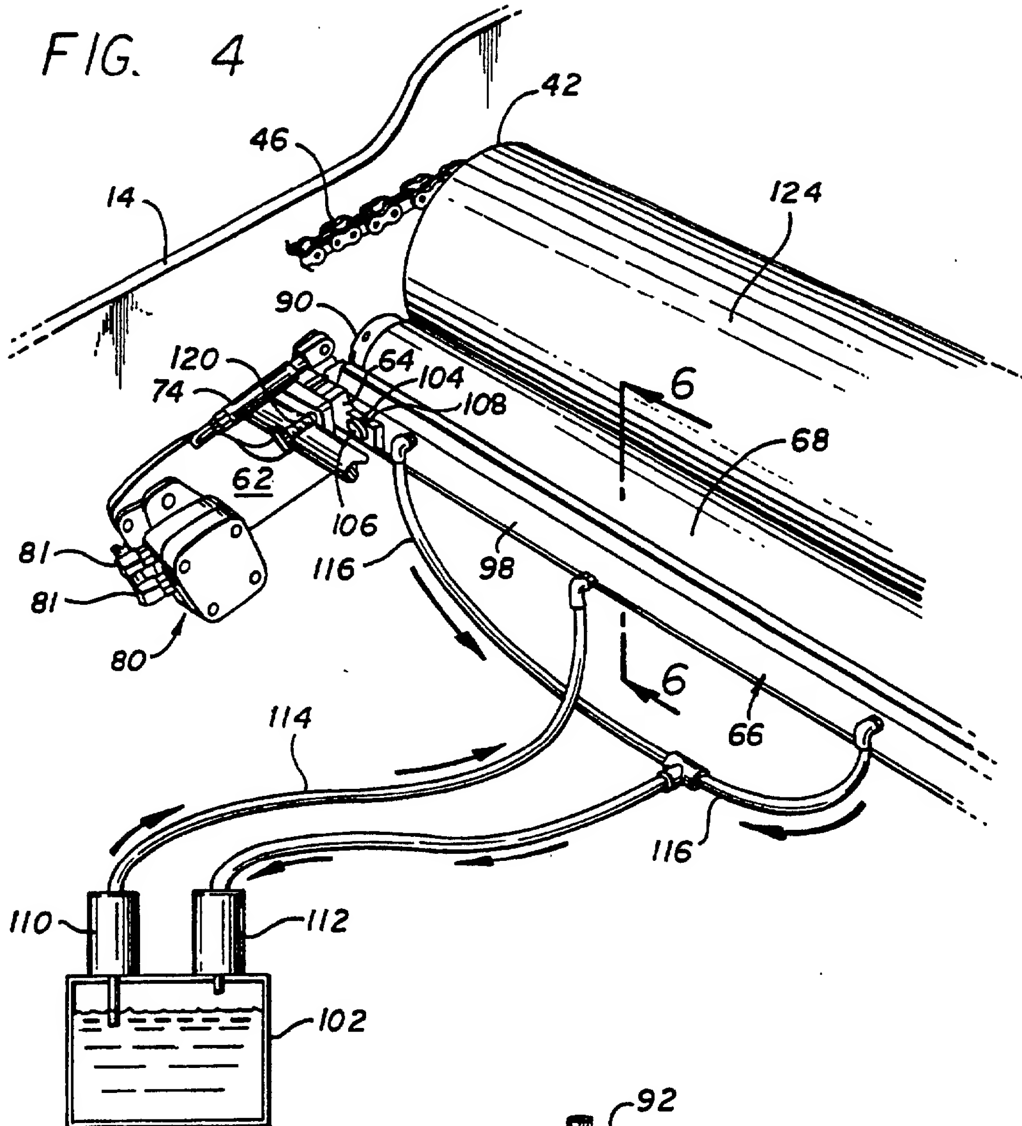
FIG. 3

FIG. 4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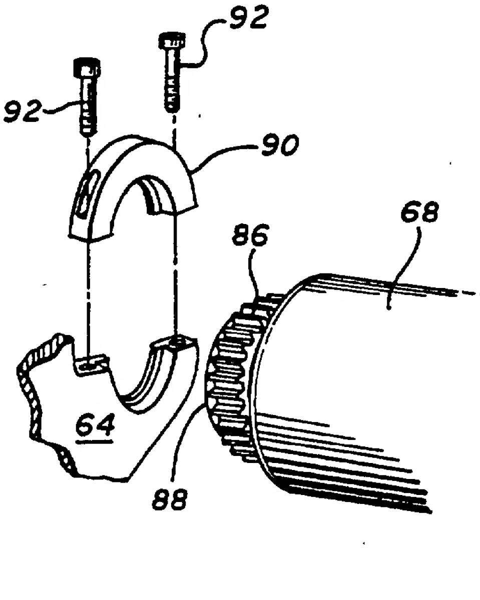
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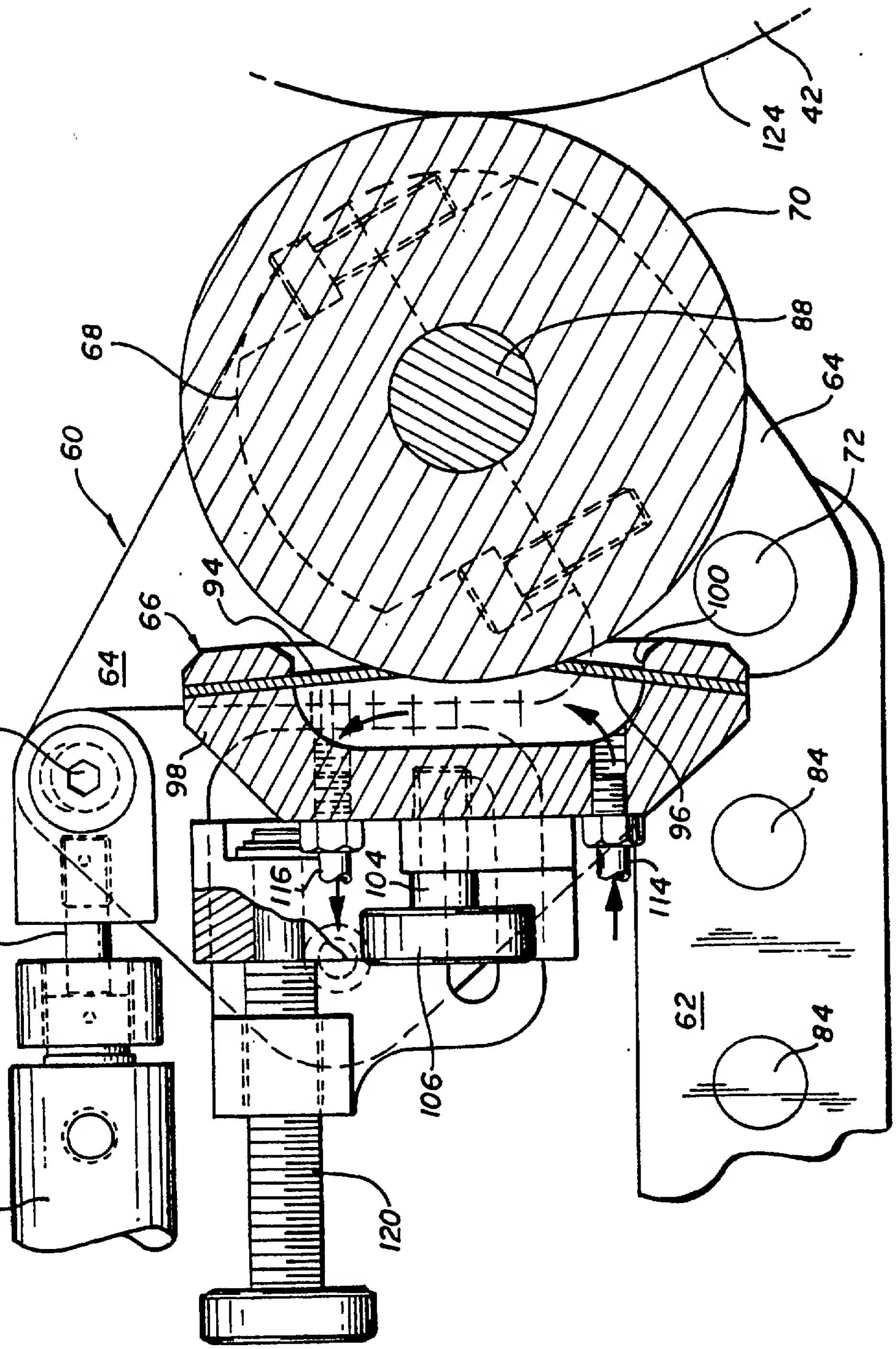
FIG. 5

FIG. 6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COATING APPARATUS FOR SHEET-FED, OFFSET ROTARY PRINTING PRESSES

BACKGROUND OF THE INVENTION

This invention relates to sheet-fed, offset rotary printing presses, and more particularly, to a new and improved apparatus for the in-line application of protective and decorative coatings to the printed surface of freshly printed sheets.

Conventional sheet-fed, offset rotary printing presses typically include one or more printing stations through which individual sheets are fed and printed with wet ink. After final printing, the sheets are fed by a delivery conveyor system to the delivery end of the press where the freshly printed sheets are collected and stacked. In a typical sheet-fed, offset rotary printing press such as the Heidelberg Speedmaster line of presses, the delivery conveyor system includes a pair of endless gripper chains carrying laterally spaced gripper bars and grippers which are used to grip and pull freshly printed sheets from the impression cylinder and convey the sheets toward the sheet delivery stacker. The gripper chains are driven in precisely timed relation to the impression cylinder by gripper chain sprocket wheels laterally spaced between a delivery drive shaft mounted on opposite sides of the press frame, the delivery drive shaft being mechanically coupled by gears for synchronous rotation with the impression cylinder.

Since the inks used with offset type printing presses typically remain wet and tacky for some time after printing, special precautions must be taken to insure that the wet inked surface of the freshly printed sheets are not marked or smeared as the sheets are transferred from one printing station to another, and through the delivery system to the sheet delivery stacker. One system for insuring that the freshly printed sheets are not marked or smeared during transfer is the transfer or delivery cylinder system marketed by Printing Research, Inc., of Dallas, Texas under its registered trademark "SUPER BLUE" That system, which is made and sold under license, is made in accordance with and operates as described in U.S. Pat. No. 4,402,267, issued Sep. 6, 1983 to Howard W. DeMoore, the disclosure of which is incorporated herein by this reference. In that system, marking and marring of freshly printed sheets is prevented by employing transfer or delivery cylinders provided with a coating of friction reducing material such as PTFE (Teflon) over which are loosely mounted fabric covers, referred to in the trade as "nets", and which support the wet ink side of the freshly printed sheets as they are pulled from the impression cylinder. Typically, in a multi-color press employing the "SUPER BLUE" cylinder system, each transfer cylinder for conveying the freshly printed sheets from one printing station to the next is supplied with a "SUPER BLUE" transfer cylinder system, and the delivery cylinder for conveying the sheets from the last printing station to the sheet delivery stacker is supplied with a "SUPER BLUE" delivery cylinder system. As used hereinafter, the term "net type cylinder" is intended to refer to cylinders having fabric nets disposed over the support surface, such as of the general type disclosed in the aforementioned DeMoore U.S. Pat. No. 4,402,267 and exemplified by the "SUPER BLUE" cylinder system.

Another system which can be used to prevent marking and smearing of the freshly printed sheets is that disclosed in U.S. application Ser. No. 07/630,308 filed Dec. 18, 1990 entitled Vacuum Transfer Apparatus for Sheet-Fed Printing Presses now U.S. Pat. No. 5,127,329. That application, the disclosure of which is also incorporated herein by reference, discloses an apparatus which can be employed to draw the unprinted side of a freshly printed sheet into engagement with rollers which support the sheet on the unprinted side during transfer or delivery of the sheet from the impression cylinder after printing so that the wet ink on the freshly printed sheet does not come in contact with other apparatus in the press. The vacuum transfer apparatus disclosed in that application can be used as an alternative to the net type cylinder system disclosed in the aforementioned DeMoore patent, or when used in a perfecting press, as a supplement to that system, the vacuum transfer apparatus being primarily intended for use when only one-sided sheet printing is being performed by the press, and the net type cylinder system being used when the press is operating in the perfector mode with two-sided sheet printing.

In some printing applications, it is desirable that the press be capable of applying a protective and/or decorative coating over all or a portion of the surface of the printed sheets. Such coatings typically are formed of a UV-curable or water-soluble resin applied as a liquid solution or emulsion by an applicator roller over the freshly printed sheets to protect the ink and improve the appearance of the sheets. Use of such coatings is particularly desirable when decorative or protective finishes are required such as in the production of posters, record jackets, brochures, magazines, folding cartons and the like. In cases where a coating is to be applied, the coating operation is carried out after the final ink printing has been performed, most desirably by an in-line coating application, rather than as a separate step after the printed sheets have been delivered to the sheet delivery stacker.

Various suggestions have been made for applying the coating as an in-line press operation by using the final printing station of the press as the coating application station. For example, in U.S. Pat. Nos. 4,270,483, 4,685,414, and 4,779,557 there are disclosed coating apparatus which can be moved into position to allow the blanket cylinder of the last printing station of a press to be used to apply a coating material to the sheets. In U.S. Pat. No. 4,796,556 there is disclosed a coating apparatus which can be selectively moved between the blanket cylinder or the plate cylinder of the last printing station of the press so that that station can be used as a coating station for the press. However, when coating apparatus of these types are used, the last printing station can not be used to apply ink to the sheets, but rather can only be used for the coating operation. Thus, with these types of in-line press coating apparatus, the press loses the capability of printing its full range of colors since the last printing station is converted to a coating station.

Suggestions for overcoming the problem of the loss of a printing station when coating is desired have also been made, such as that set forth in U.S. Pat. Nos. 4,934,305 which discloses a coating apparatus having a separate timed applicator roller positioned to apply the coating material to the printed sheet while the sheet is on the last impression cylinder of the press. This is said to allow the last printing station to be operated simultaneously as both an ink application station and a coating

station so that no loss of press printing unit capability results. Another approach to providing a coating station without loosing the printing capabilities of the last printing station is to provide a totally separate coating unit down stream of the last printing station so that the coating is applied to the sheets after final printing and before the sheets have reached the sheet delivery stacker. Such an approach is suggested in U.S. Pat. Nos. 4,399,767 and 4,706,601. While each of these suggestions provide coating stations which allow the final printing station to continue to be used for printing, they each suffer from the disadvantages of requiring the provision of separately driven coating applicator rollers and apparatus which must be precisely timed in relation to the movement of the sheet to be coated so as to insure precise registration between application of the coating material and the printed sheet. The provision of separate timed applicator rollers require that the presses be modified to provide sufficient space within the presses to accommodate the added coating apparatus or to increase the length of the presses, and require additional and complex drive connections with the press drive system to achieve the required precise speed correlation between the sheets and the applicator rollers. Such modifications can be both expensive and cumbersome to install and maintain.

Thus, there exists a need for a new and improved in-line apparatus for use in a sheet-fed, offset rotary printing press to selectively apply a protective and/or decorative coating to the printed surface of freshly printed sheets which allows the final press printing station to continue to be used as a printing station, yet which does not require any substantial press modification or the addition of a separate timed applicator roller. As will be explained in more detail hereinafter, the present invention solves this need in an novel and unobvious manner.

SUMMARY OF THE INVENTION

The present invention provides a new and improved in-line apparatus for selectively applying a protective and/or decorative coating to the surface of freshly printed sheets in a sheet-fed, offset rotary printing press which is highly reliable and effective in use, yet which does not require any expensive or substantial press modification or result in any impairment of normal press operating capability. The present invention enables the press to be used to selectively apply the coating material to the freshly printed sheets as the sheets are conveyed from the impression cylinder of the last printing station of the press toward the sheet delivery stacker by utilizing a delivery cylinder mounted to the existing press delivery drive shaft to perform the dual function of a coating material applicator roller and a sheet delivery cylinder so that no modification of the press is required to enable the press to be used for either coating or noncoating operation, and without impairment of any normal press operations.

More specifically, the present invention is intended for use in a sheet-fed, offset rotary printing press of the type having at least one printing station which includes a blanket cylinder and an impression cylinder disposed for printing ink onto sheets passing therebetween, and a delivery conveyor system for pulling freshly printed sheets off the impression cylinder and transporting the sheets toward the press sheet delivery stacker. For use of the present invention, the press must include a delivery drive shaft disposed adjacent to and extending parallel with the impression cylinder, and which is driven in timed synchronous relation with the impression cylinder.

In accordance with the invention, a delivery cylinder is mounted to the delivery drive shaft and provided with a coating blanket disposed over the peripheral outer surface of the cylinder, and adapted to engage and support the wet ink side of a freshly printed sheet. A coating apparatus including a supply of liquid coating material and a pick-up roller disposed to receive coating material from the supply, is mounted to the press and operable to permit the pick-up roller to be moved into engagement with the delivery cylinder so that coating material on the pick-up roller is transferred to the coating blanket of the delivery cylinder and then to the freshly printed sheet.

Preferably, the coating apparatus is mounted to the press downstream of the delivery drive shaft, and includes means to selectively move the pick-up roller into and out of engagement with the delivery cylinder. When the pick-up roller is not in the operable position in engagement with the delivery cylinder, the delivery cylinder can be used for conventional noncoating sheet delivery by removing the coating blanket and, preferably, replacing the coating blanket with a fabric net such as of the net type cylinder system previously described. To convert to a coating operation, the coating blanket is attached to the delivery cylinder and, depending upon the thickness of the sheets to be printed, packed with suitable packing sheets to increase the effective diameter of the cylinder so that pressure is applied to the freshly printed sheets against the impression cylinder by the coating blanket covered delivery cylinder. The pick-up roller is then moved to the operative position engaged with the delivery cylinder so that as freshly printed sheets are pulled by the delivery conveyor from the impression cylinder around the delivery cylinder, coating material applied to the delivery cylinder by the pick-up roller is transferred to the freshly printed sheets in the nip between the delivery cylinder and the impression cylinder.

Since the delivery cylinder is driven by the delivery drive shaft in precise timed relation with the impression cylinder, exact registration between the application of coating material and the printed sheet is assured. Further, since the coating of the freshly printed sheets is carried out through use of a delivery cylinder mounted to the existing press delivery drive shaft, no substantial press modifications are required, and the press can be quickly and easily converted between coating and noncoating operation with no loss of printing capability of the final printing station.

Many other features and advantages of the present invention will become more apparent from the following detailed description take in conjunction with the accompanying drawings which disclose, by way of example, the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic side elevational view of a sheet-fed, offset rotary printing press having a coating apparatus embodying the present invention;

FIG. 2 is an enlarged fragmentary side elevational view taken substantially within the circular area designated "2" in FIG. 1 and showing the coating apparatus of the present invention during coating operation;

FIG. 3 is a side elevational view similar to FIG. 2, but showing the coating apparatus in the inoperative posi-

tion with the coating pick-up roller and reservoir removed, and the blanket covering over the delivery cylinder replaced with a fabric net for non-coating printing;

FIG. 4 is an enlarged fragmentary perspective view showing one side of the coating apparatus mounted in the press and illustrating the fluid path of coating material from a supply tank to the reservoir of the coating unit;

FIG. 5 is an enlarged fragmentary perspective view illustrating the end mounting of the coating pick-up roller to its support bracket; and

FIG. 6 is an enlarged fragmentary sectional view taken substantially along the lines 6—6 of FIG. 4.

DETAILED DESCRIPTION OF PRESENTLY PREFERRED EMBODIMENT

As shown in the exemplary drawings, the present invention is embodied in a new and improved in-line apparatus, herein generally designated **10**, for selective use in applying a protective and/or decorative coating to the freshly printed surface of sheets printed in a sheet-fed, offset rotary printing press, herein generally designated **12**. In this instance, as shown in FIG. **1**, the coating apparatus **10** is illustrated as installed in a four color printing press **12**, such as that manufactured by Heidelberger Druckmaschinen AG of the Federal Republic of Germany under its designation "Heidelberg Speedmaster 102V (40")," and which includes a press frame **14** coupled at one end, herein the right end, with a sheet feeder **16** from which sheets, herein designated **18**, are individually and sequentially fed into the press, and at the opposite end, with a sheet delivery stacker **20** in which the finally printed sheets are collected and stacked. Interposed between the sheet feeder **16** and the sheet delivery stacker **20** are four substantially identical sheet printing stations **22**, **24**, **26** and **28** which can print different color inks onto the sheets as they are moved through the press **10**.

As illustrated, each of the printing stations **22**, **24**, **26** and **28** is substantially identical and of conventional design, herein including a sheet feed cylinder **30**, a plate cylinder **32**, a blanket cylinder **34** and an impression cylinder **36**, with each of the first three printing stations **22**, **24**, and **26** having a transfer cylinder **38** disposed to withdraw the freshly printed sheets from the adjacent impression cylinder and transfer the freshly printed sheets to the next printing station via a transfer drum **40**. The final printing station **28** herein is shown as equipped with a delivery cylinder **42** which functions to support the printed sheet **18** as it is moved from the final impression cylinder **36** by a delivery conveyor system, generally designated **44**, to the sheet delivery stacker **20**.

The delivery conveyor system **44** herein is of conventional design and includes a pair of endless delivery gripper chains **46**, only one of which is shown in the drawings, carrying at regular spaced locations along the chains, laterally disposed gripper bars **48** having gripper elements **50** used to grip the leading edge of a sheet **18** after it leaves the nip between the delivery cylinder **42** and impression cylinder **36** of the last printing station **28**. As the leading edge of the sheet **18** is gripped by the grippers **50**, the delivery chains **46** pull the sheet away from the impression cylinder **36** and convey the freshly printed sheet to the sheet delivery stacker **20** where the grippers release the finally printed sheet. The endless delivery chains **46** are driven in synchronous timed relation to the impression cylinder **36** by sprocket wheels **52** fixed adjacent the lateral ends of a delivery drive shaft **54** which has a mechanically geared coupling (not shown) through the press drive system to the impression cylinder. The delivery drive shaft **54** extends laterally between the sides of the press frame **14** adjacent the impression cylinder **36** of the last printing station **28**, and is disposed to be parallel with the axis of the impression cylinder. In this instance, the delivery cylinder **42**, which is constructed to allow adjustments in diameter by suitable means, is fixedly mounted to the delivery drive shaft **54** so that the delivery cylinder is also rotated in precise timed relation to the impression cylinder.

Preferably, each of the transfer cylinders **38** is equipped with an anti-marking system such as the aforementioned net type transfer cylinder system or the press **12** can be supplied in the transfer positions with vacuum transfer systems of the type disclosed in the above-identified copending U.S. application Ser. No. 07/630,308 filed Dec. 18, 1990, although as will become more apparent hereinafter, the use of such transfer systems is not required for the present invention and other types of transfer systems can be used. For reasons that will become more apparent hereinafter, for most effective use of the present invention, however, the delivery cylinder **42** should be of the type which employs the "SUPER BLUE" delivery cylinder system, or, as an alternative, should employ in the delivery position, a vacuum transfer system such as disclosed in the above-identified copending U.S. application Ser. No. 07/630,308.

In this respect, it is important to note that when the freshly printed sheets **18** are conveyed away from the impression cylinder **36** of the final printing station **28** by the gripper **50** carried by the delivery chains **46**, the wet inked surfaces of the sheets face the delivery drive shaft **54** and the sheets must be supported such that the ink is not marked or smeared as the sheets are transferred. Typically, such support is provided by skeleton wheels or cylinders mounted to the press delivery drive shaft **54**, or as is now more commonly used, net type delivery cylinders such as of the "SUPER BLUE" delivery cylinder system type disclosed in the aforementioned DeMoore patent. More recently, vacuum transfer apparatus of the type disclosed in the aforementioned copending U.S. application Ser. No. 07/630,308 have been used in place of delivery cylinders or skeleton wheels to pull the unprinted side of the sheet away from the delivery drive shaft **54** so that the wet ink surface of the sheets do not come into contact with any press apparatus. It has been found, however, that when a protective or decorative coating material is applied to the wet ink surface of the sheets, the coating protects the wet ink against marking and smearing such that the coating applicator roller itself can be used to support the wet inked surface of the sheets without fear of damage to the freshly printed surface.

In accordance with the present invention, the in-line coating apparatus **10** for selectively applying the protective or decorative coating to the sheets **18** enables the press **12** to be operated in the normal manner without the loss of the final printing station **28**, and without requiring any substantial press modifications by employing the existing press delivery drive shaft **54** as the mounting location for the coating applicator roller. In presses **12** utilizing a net type delivery cylinder system, that system can be quickly and easily converted to perform the dual function of being a coating applicator roller and a delivery cylinder. In presses having other

types of delivery systems such as skeleton wheels mounted on the delivery drive shaft 54 or a vacuum transfer apparatus as disclosed in the aforementioned copending U.S. application Ser. No. 07/630,308, conversion to a coating operation can be quickly and easily achieved by mounting on the press delivery drive shaft in place of the skeleton wheels or in addition to the vacuum transfer apparatus, a suitable support cylinder capable of performing the combined function of a coating applicator roller and a delivery cylinder 42. Typically, such a support cylinder will have a diameter which provides no more than about a 0.090 inch clearance between the cylinder support surface and the adjacent impression cylinder 36. By utilizing the delivery cylinder 42 mounted on the delivery drive shaft 54 to also act as a coating applicator roller, the present invention insures that the coating will be applied to the printed sheet 18 in precise timed registration, and will permit the press to be operated with its full range of printing stations, yet allow fast, simple and convenient change-over from coating to noncoating operations, and vice versa, with a minimum of press down time.

Toward these ends, the coating apparatus 10 of the present invention includes a relatively simple, positive acting and economical coating unit, generally designated 60, mounted to the press frame 14 down stream of the delivery drive shaft 54 and positioned to selectively supply coating material to the support surface of a delivery cylinder 42 mounted on the delivery drive shaft. As best can be seen in FIGS. 2, 4 and 6, the coating unit 60 herein comprises a pair of side frames 62, only one of which is shown, it being understood that the other side frame is substantially the same as that of the side frame illustrated, attached to each side of the press frame 14. Pivotally mounted to one end of each of the side frames 62 is a support bracket 64 carrying one end of a coating material reservoir 66 and cooperating coating material pick-up roller 68 each disposed to extend laterally across the press 12 parallel with the delivery drive shaft 54. The coating unit 60 is mounted between the upper and lower runs of the delivery chains 46 down stream of the delivery drive shaft 54, and positioned so that the outer peripheral surface 70 of the pick-up roller 68 can be frictionally engaged with the support surface of a delivery cylinder 42 mounted on the delivery drive shaft.

As best seen in FIGS. 2 through 4, the support bracket 64 is pivotally attached to the end of the side frame 62 by a shaft 72 disposed at the lower end portion of the bracket, and can be pivoted about the shaft by an extensible cylinder 74, herein shown as a hydraulic cylinder, one end 76 of which is secured such as by welding to the side frame, and the opposite end 78 of which is coupled through a pivot shaft 79 to the upper end portion of the bracket. By extending or retracting the cylinder 74, the extent of frictional engagement of the pick-up roller 68 with the surface of the delivery cylinder 42 can be controlled, and the pick-up roller can be completely disengaged from the delivery cylinder.

The coating pick-up roller 68, which can be of conventional design and preferably one such as the Anilox rollers manufactured by A.R.C. International of Charlotte, N.C., and sold under the name "PRINTMASTER" having an engraved ceramic or chrome outer peripheral surface 70, is designed to pick up a predetermined uniform thickness of coating material from the reservoir 66, and then uniformly transfer the coating to the support surface of the delivery cylinder 42. To effect rotation of the pick-up roller 68, a suitable motor 80, herein a hydraulic motor, is attached to one of the side frames 62 and coupled to a suitable hydraulic fluid source (not shown) through fittings 81. Attached to the output of the motor 80 is an output gear which is drivingly coupled through a reduction gear 81 and a series of idler gears 82 each mounted on stub axles 84, to a drive gear 86 attached to the end of a shaft 88 on which the pick-up roller 68 is concentrically mounted. The shaft 88 of the pick-up roller 68 is, in turn, journaled at each end to the brackets 64 through a releasable semicircular collar 90 (see FIG. 5) attached by bolts 92 to the bracket. Herein, the axle of the terminal idler gear, designated 82', also serves as the shaft 72 for pivotally mounting the support bracket 64 to the side frame 62 so that when the bracket is rotated about the shaft, the terminal idler gear remains engaged with the drive gear 86 of the pick-up roller 68.

In this instance, as best as can be seen in FIG. 6, the pick-up roller 68 has a portion which projects laterally into the reservoir 66 containing the supply of coating material, and a pair of upper and lower inclined doctor blades 94 and 96 attached to the reservoir engage the roller surface to meter the coating material picked up from the reservoir by the etched surface 70 of the roller. The reservoir 66 herein is formed by an elongated, generally rectangular housing 98 having a generally C-shaped cross-section with a laterally extending opening 100 along one side facing the pick-up roller 68, and is supplied with coating material from a supply tank 102 disposed in a remote location within or near the press 12. Preferably, the reservoir 66 is removably attached to the brackets 64, herein by bolts 104 having enlarged, knurled heads 106, and which can be threaded through slots 108 formed in the brackets to clamp the reservoir in place on the brackets.

To insure that an adequate supply of coating material is always present within the reservoir 66 and to prevent coagulation and clogging of the doctor blades 94 and 96 by the aqueous coating material, the coating material is circulated through the reservoir, herein by two substantially identical pumps 110 and 112, one of which pumps coating material from the supply tank 102 via a supply line 114 to the bottom of the reservoir, and the other of which acts to provide suction to a pair of return lines 116 coupled adjacent the top of the reservoir for withdrawing unused coating material from the reservoir. By circulating the coating material from the supply tank 102 at a greater rate than the rate of withdrawal of material by the pick-up roller 68, a substantially constant supply of coating material will always be present within the reservoir 66.

In this instance, the general arrangement of the pick-up roller 68, doctor blades 94 and 96, and reservoir 66 is substantially like that disclosed in U.S. Pat. No. 4,821,672 entitled DOCTOR BLADE ASSEMBLY WITH ROTARY END SEALS AND INTERCHANGEABLE HEADS", the disclosure of which can be reviewed for details concerning the structure and operation of a pick-up roller and reservoir usable with the present invention.

Once the coating unit 60 has been installed in a press 12, which basically only requires that the side frames 62 be attached, such as with bolts, to the sides of the press frame 14, and the hydraulic motor 80 be coupled with a suitable hydraulic source, the press can be quickly and easily converted to the coating mode. In presses 12 already supplied with a net type delivery cylinder sys-

tem, to convert to a coating operation, all that is necessary is that the fabric net material (designated 122 in FIG. 3) normally used over the support surface of the net type delivery cylinder during noncoating press operations, be removed and replaced with a coating blanket 124 capable of transferring coating material deposited thereon onto the printed sheets. Typically, such a blanket 124 can be formed as a rubber covering such as used for the covering surface of the conventional blanket cylinders 34 of the press 12. In presses 12 having conventional skeleton wheels or a vacuum transfer type apparatus such as that of the aforementioned copending U.S. application Ser. No. 07/630,308, a suitable delivery cylinder 42 can be fixed to the delivery drive shaft 54 and a similar coating blanket 124 applied thereto over the cylinder surface.

It is important to note that during nonprinting operations, the net type delivery cylinder 42 does not engage the surface of the impression cylinder 36 during sheet delivery. However, when used as a coating applicator roller during coating operations, the effective diameter of the delivery cylinder 42 must be increased so that the coating blanket 124 presses the sheet 18 against the surface of the impression cylinder 36, as shown in FIG. 2. To increase the effective diameter of the delivery cylinder 42, the thickness of the coating blanket 124 applied over the support surface of the delivery cylinder 42 can be selected to correspond with the thickness of the sheets 18 to be printed, or suitable packing sheets, such as paper sheets (not shown) of the type conventionally used in conjunction with press blanket cylinders 34, can be interposed between the delivery cylinder and the coating blanket.

While any suitable means can be used to attached the coating blanket 124 to the support surface of the delivery cylinder 42, in this instance, as shown in FIGS. 2 and 3, the delivery cylinder is supplied with clamps 126 attached by bolts 127 to the cylinder adjacent the leading edge 130 to secure the leading edge of the coating blanket 124 to the cylinder, and adjustable tensioning clamps 128 are provided adjacent the cylinder trailing edge 132 for securing the trailing edge of the blanket to the cylinder. However, the tensioning claims 128 are pivotally mounted at one end by a pin 129 to the cylinder 42, and the blanket tension is adjusted through a bolt 131 and nut 133 arrangement. Depending upon the thickness of the sheets 18 to be printed and coated by the press 12, one or more layers of packing paper or the like may be interposed between the support surface of the delivery cylinder 42 and the coating blanket 124 to increase the effective diameter of the cylinder. Provision of the tensioning clamps 128 for attaching the coating blanket 124 to the leading edge 132 of the delivery cylinder 42 allows for such control and adjustment.

Once installed, the coating unit 60 can remain in position even though the press 12 is operated in the non-coating mode. In this respect, when the coating unit 60 is not in operation, the extensible cylinder 74 can be actuated to pivot the support brackets 64 carrying the pick-up roller 68 and reservoir 66 about the shaft 72 and away from the delivery cylinder 42, thus rendering the coating unit inoperative. This then also frees the pick-up roller 68 and reservoir 66 for fast and easy removal from the coating unit 60 for cleaning, service or replacement. To remove the pick-up roller 68, the coating material is drained from the reservoir 66, and the pressure exerted by the doctor blades 94 and 96 against the roller is released, therein through operation of a pressure adjustment screw 120 attached to the reservoir, and the bolts 92 and collars 90 are removed, thereby permitting the pick-up roller to be lifted from the coating unit 60. To remove the reservoir 66, all that need be done is to release the mounting bolts 104 securing the reservoir to the brackets 64. With the coating unit 60 moved by the extensible cylinder 74 to the inoperative position, the delivery cylinder 42 can be converted for normal delivery cylinder operation simply by removing the coating blanket 124 from the delivery cylinder 42 and replacing the blanket with a fabric net 122. Alternatively, if a vacuum transfer apparatus such as described in the aforementioned copending U.S. application Ser. No. 07/630,308 is installed in the press 12, that apparatus can be activated to deliver sheets from the impression cylinder 36 without effecting any delivery cylinder change since the freshly printed side of the sheets will not come into contact with the delivery cylinder.

In a typical noncoating operation of the press 12 with the coating apparatus 10 installed, the coating unit 60 will be in the inoperative position. In that situation and with a net type delivery cylinder 42 installed, the delivery cylinder will be covered with the fabric net 122 so that the delivery cylinder operates in the normal manner with the wet ink side of the freshly printed sheets 18 being supported by the net covered surface of the delivery cylinder. Should the press 12 include a vacuum transfer apparatus such as disclosed in the aforementioned copending U.S. application Ser. No. 07/630,308, the delivery cylinder 42 can remain on the delivery drive shaft 54, with or without a fabric net 122, depending upon whether or not the press is used for perfector printing.

When it is desired to convert to the coating mode of operation, the press 12 is stopped just long enough to replace the fabric net 122 on the delivery cylinder 42 with the coating blanket 124 packed to the required extent necessary for providing the proper pressure to effect coating of the sheet thickness to be printed. Thereafter, the pumps 110 and 112 are activated and the press 12 re-started. The extensible cylinder 74 can then be activated to control the pressure of the pick-up roller 68 against the delivery cylinder 42 to obtain the desired application of coating material to the freshly printed sheets 18.

Notably, with the coating apparatus 10 of the present invention, no timing adjustments between the delivery cylinder 42 and the impression cylinder 36 are required to achieve and maintain precise registration between application of the coating material and the printed surface of the sheets 18. Further, the coating unit 60 permits a wide range of coating weights to be applied to the printed sheets 18 by quickly and easily changing pick-up rollers 68 from those designed to produce a very light coating application to those designed to produce a very thick coating application can be used.

From the foregoing, it should be apparent that the coating apparatus 10 of the present invention provides a highly reliable, effective and economical in-line apparatus for selectively applying coating material to the freshly printed sheets 18 in a sheet-fed, offset rotary printing press 12 which allows the final printing station to continue to be used as a print station, yet which does not require any substantial press modification or the addition of a separate timed applicator roller. While a particular form of the present invention has been illustrated and described, it should be apparent that varia-

tions and modifications therein can be made without departing from the spirit and scope of the invention.

We claim:

1. In a sheet-fed, offset rotary printing press of the type including at least one printing station having a blanket cylinder and an impression cylinder disposed for printing ink onto sheets passing therebetween, and a delivery conveyor system for pulling freshly printed sheets from the impression cylinder and transporting the printed sheets toward a sheet delivery stacker, the delivery conveyor system including a delivery drive shaft disposed adjacent to and extending parallel with the impression cylinder and driven in timed synchronous relation with the impression cylinder, the improvement comprising:

a delivery cylinder mounted to said delivery drive shaft and having an outer peripheral support surface adapted to engage and support a sheet being transported by said delivery conveyor system;

a coating apparatus including a supply of liquid coating material, a rotatable pick-up roller having an outer peripheral surface of substantially cylindrical shape, and means for applying a coating of liquid coating material from said supply onto said outer peripheral surface of said pick-up roller; and

means for mounting said coating apparatus to the press adjacent said delivery cylinder including selectively operable means for moving said pick-up roller between a first operable position with a portion of said peripheral surface of said pick-up roller engaged with said support surface of said delivery cylinder, and a second inoperable position with said peripheral surface out of engagement with said support surface of said delivery cylinder, whereby when said pick-up roller is in said first operable position, liquid coating material from said supply applied onto said peripheral surface of said pick-up roller is transferred to said support surface of said delivery cylinder and to said freshly printed sheet.

2. The improvement as set forth in claim 1 wherein said delivery cylinder includes a coating blanket disposed over said peripheral support surface.

3. The improvement as set forth in claim 1 wherein said delivery cylinder includes a removable coating blanket disposed over said peripheral support surface when said pick-up roller is in said first operable position.

4. The improvement as set forth in claim 3 wherein said coating blanket has a rubber outer surface.

5. The improvement as set forth in claim 3 wherein said delivery cylinder includes a fabric net disposed over said peripheral support surface when said pick-up roller is in said second inoperable position.

6. The improvement as set forth in claim 1 wherein said coating apparatus includes an elongated reservoir containing said supply of liquid coating material, said reservoir being disposed to extend parallel with said pick-up roller with a portion of said peripheral surface extending into said reservoir in contact with liquid coating material contained therein, and at least one doctor blade attached to said reservoir and engaging said peripheral surface, said doctor blade acting to limit the amount of liquid coating material applied onto said peripheral surface from said reservoir.

7. The improvement as set forth in claim 6 wherein said reservoir and said pick-up roller are movably coupled to said press and said selectively operable means includes an extensible cylinder coupled between said reservoir and said press and operable to move said reservoir and said pick-up roller between said first and second positions.

8. The improvement as set forth in claim 7 wherein said pick-up roller is rotatably driven by a motor attached to said coating apparatus.

9. The improvement as set forth in claim 8 wherein said delivery cylinder includes a rubber coating blanket disposed over said peripheral support surface when said pick-up roller is in said first operable position, and includes a fabric net disposed over said peripheral support surface when said pick-up roller is in said second inoperable position.

10. The improvement as set forth in claim 9 wherein said coating apparatus is mounted to said press downstream of said delivery drive shaft in the direction of travel of said sheets during transport by said delivery conveyor system.

11. The improvement as set forth in claim 1 wherein said mounting means includes first and second side frames mounted on said press, a support shaft mounted on and extending between said first and second side frames, a support bracket attached to said coating apparatus and movably coupled to said support shaft for pivotal movement between said first and second positions, and said selectively operable means includes an extensible cylinder coupled between said coating apparatus and said support bracket and operable to move said coating apparatus toward and away from said delivery cylinder.

12. In a sheet-fed, offset rotary printing press of the type including at least one printing station having a blanket cylinder and an impression cylinder disposed for printing wet ink onto sheets passing therebetween, and a delivery conveyor system for pulling freshly printed sheets from the impression cylinder and transporting the printed sheets toward a sheet delivery stacker, the delivery conveyor system comprising a pair of endless gripper chains disposed on opposite sides of the press and supporting therebetween gripper bars and grippers spaced along the chains, the gripper chains being driven in timed synchronous relation with the impression cylinder by laterally spaced sprocket wheels mounted on opposite ends of a delivery drive shaft disposed adjacent to and extending parallel with the impression cylinder, the improvement comprising:

a delivery cylinder mounted to said delivery drive shaft between said sprocket wheels and having an outer peripheral support surface covered by a removable coating blanket adapted to engage and support the wet ink side of a sheet being transported by said gripper bars;

a coating apparatus including a supply of liquid coating material, a rotatable pick-up roller having an outer peripheral surface of substantially cylindrical shape communicating with said supply, and means for applying liquid coating material from said supply onto said peripheral surface of said pick-up roller; and,

means for mounting said coating apparatus to the press adjacent the delivery cylinder, said means including selectively operable means for moving said coating apparatus between a first operable position with a portion of said peripheral surface of said pick-up roller engaged with said delivery cylinder, and a second inoperable position with said peripheral surface of said pick-up roller out of engagement with said delivery cylinder, whereby when said coating apparatus is in said first operable

position, liquid coating material from said supply metered onto said peripheral surface of said pick-up roller is transferred to said delivery cylinder and to said freshly printed sheet, and when said coating apparatus is in said second inoperable position, said delivery cylinder is disposed for non-coating sheet delivery operation.

13. The improvement as set forth in claim **12** wherein the effective diameter of said delivery cylinder covered by said coating blanket is sufficient to apply pressure to sheets against said impression cylinder as said sheets are pulled from said impression cylinder by said gripper bars.

14. The improvement as set forth in claim **13** wherein said coating blanket has a rubber outer support surface.

15. The improvement as set forth in claim **14** wherein said coating apparatus is disposed downstream of said delivery drive shaft in the direction of travel of said sheets during transport by said delivery conveyor system.

16. A sheet-fed, offset rotary printing press including:

at least one printing station having a blanket cylinder and an impression cylinder disposed for printing wet ink onto sheets passing therebetween;

a delivery conveyor system for pulling freshly printed sheets from the impression cylinder and transporting the printed sheets toward a sheet delivery stacker, the delivery system including a delivery drive shaft;

a delivery cylinder mounted to said delivery drive shaft and having an outer peripheral support surface adapted to engage and support a sheet being transported by said delivery conveyor system;

a coating apparatus including a supply of liquid coating material, a rotatable pick-up roller having an outer peripheral surface of substantially cylindrical shape communicating with said supply, and means for applying liquid coating material from said supply onto said peripheral surface of said pick-up roller; and

means for mounting said coating apparatus to the press adjacent said delivery cylinder, said means including selectively operable means for moving said pick-up roller between a first operable position with a portion of said peripheral surface of said pick-up roller engaged with said delivery cylinder, and a second inoperable position with said peripheral surface of said pick-up roller out of engagement with said delivery cylinder, whereby when said pick-up roller is in said first operable position, liquid coating material from said supply applied to said peripheral surface of said pick-up roller is transferred to said delivery cylinder and then to said freshly printed sheet.

17. A sheet-fed, offset rotary printing press as set forth in claim **16** wherein said delivery cylinder includes a removable coating blanket disposed over said peripheral support surface when said pick-up roller is in said first operable position.

18. A sheet-fed, offset rotary printing press as set forth in claim **17** wherein said coating blanket has a rubber outer surface.

19. A sheet-fed, offset rotary printing press as set forth in claim **17** wherein said delivery cylinder includes a fabric net disposed over said peripheral support surface when said pick-up roller is in said second inoperable position.

20. A sheet-fed, offset rotary printing press as set forth in claim **19** wherein said coating apparatus includes an elongated reservoir containing said supply of liquid coating material, said reservoir being disposed to extend parallel with said pick-up roller with a portion of said peripheral surface extending into said reservoir in contact with liquid coating material contained therein, and at least one doctor blade attached to said reservoir and engaging said peripheral surface, said doctor blade acting to limit the amount of liquid coating material applied onto said peripheral surface from said reservoir.

21. A sheet-fed, offset rotary printing press as set forth in claim **20** wherein said selectively operable means includes an extensible cylinder coupled between said reservoir and said press and operable to move said reservoir and said pick-up roller laterally between said first and second positions.

22. A sheet-fed, offset rotary printing press as set forth in claim **21** wherein said pick-up roller is rotatably driven by a motor attached to said coating apparatus.

* * * * *

14

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 5,207,159

DATED : May 4, 1993

INVENTOR(S) : Howard W. DeMoore and Steven M. Person

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 3, line 48, "inline" should be -- in-line --;

Column 8, line 3, "preferably" should be -- Preferably --; and

Column 8, line 58, "16B" should be -- 116B --.

Signed and Sealed this

Fourth Day of January, 1994

Attest:

Bruce Lehman

BRUCE LEHMAN

Attesting Officer

Commissioner of Patents and Trademarks

US005207159A

United States Patent [19]
DeMoore et al.

[11] Patent Number: 5,207,159
[45] Date of Patent: May 4, 1993

[54] COATING APPARATUS FOR SHEET-FED, OFFSET ROTARY PRINTING PRESSES

[75] Inventors: Howard W. DeMoore, 10954 Shady Trail, Dallas, Tex. 75220; Steven M. Person, Seagoville, Tex.

[73] Assignee: Howard W. DeMoore, Plano, Tex.

[21] Appl. No.: 879,841

[22] Filed: May 6, 1992

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 752,778, Aug. 30, 1991.

[51] Int. Cl.^{5} B41F 31/00
[52] U.S. Cl. 101/350; 101/351; 101/367; 101/147; 118/261; 118/262
[58] Field of Search 101/135, 147, 148, 157, 101/167, 169, 207, 208, 210, 329, 330, 331, 348, 349, 350, 351, 364, 365, 366, 367; 118/602, 612, 236, 242, 259, 261

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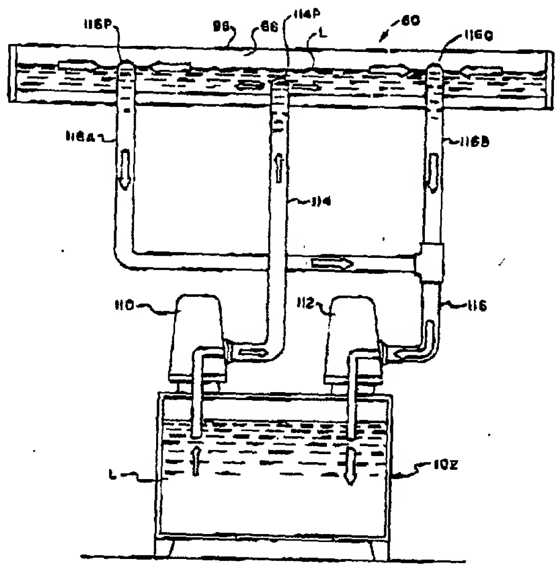
Primary Examiner—Eugene H. Eickholt
Attorney, Agent, or Firm—Dennis T. Griggs

[57] **ABSTRACT**

A coating apparatus for use in a sheet-fed or web-fed, offset rotary or flexographic printing press to apply a protective and/or decorative coating to the surface or freshly printed sheets includes a doctor blade coating unit coupled to a pickup roller for supplying liquid material from a reservoir to the surface of a pickup roller mounted on a press delivery drive shaft. Liquid material is circulated through the reservoir of the doctor blade unit by suction flow produced by a return pump. This prevents the buildup of a positive pressure differential within the doctor blade reservoir. The doctor blade reservoir is maintained at below ambient pressure level, thereby preventing leakage through the end seals. A vacuum sensor circuit provides a visual indication of air vacuum pressure in the doctor blade reservoir chamber, and a vacuum sensor switch applies electrical power to an audio transducer. The audio transducer produces an audible alarm in response to an increase in doctor blade chamber pressure, thereby providing advance warning of an impending end seal failure or a worn doctor blade condition.

21 Claims, 9 Drawing Sheets



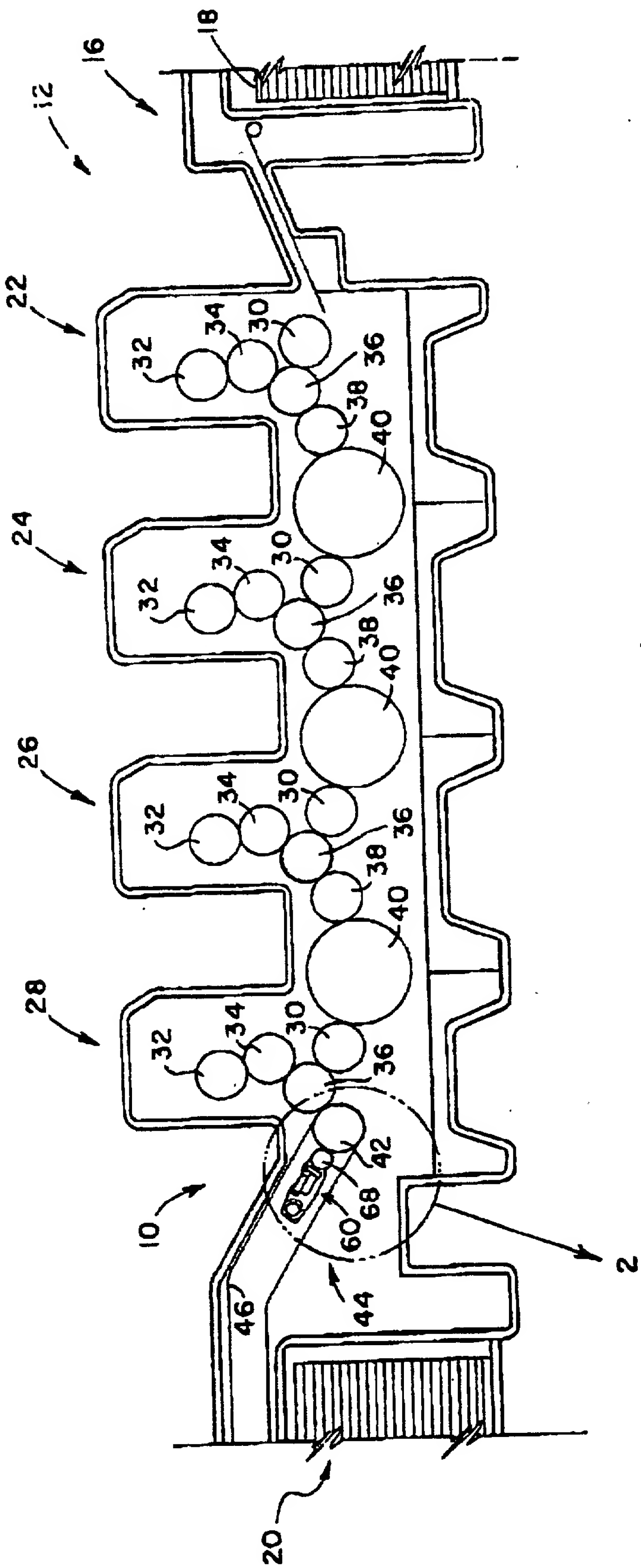


FIG. 1

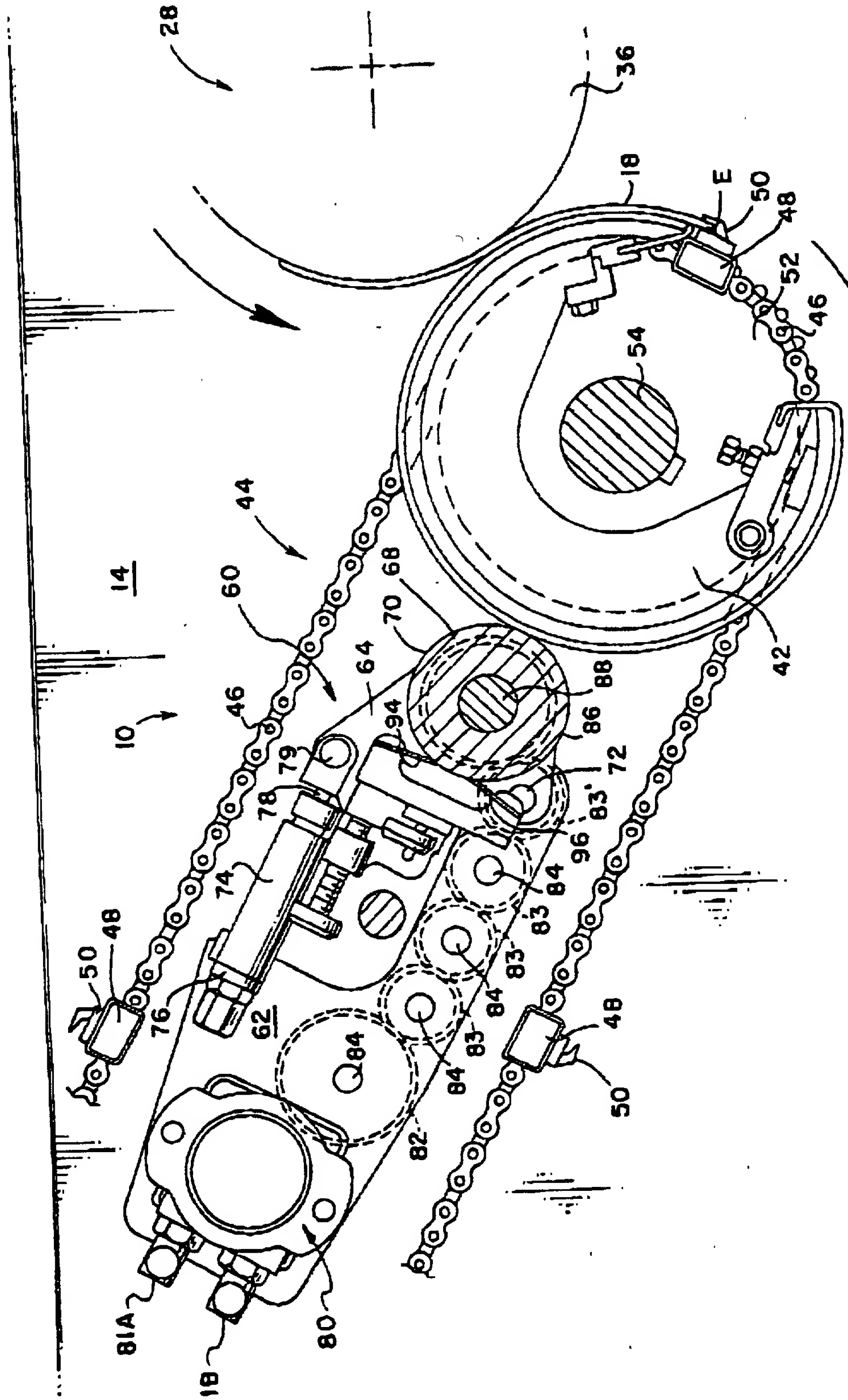

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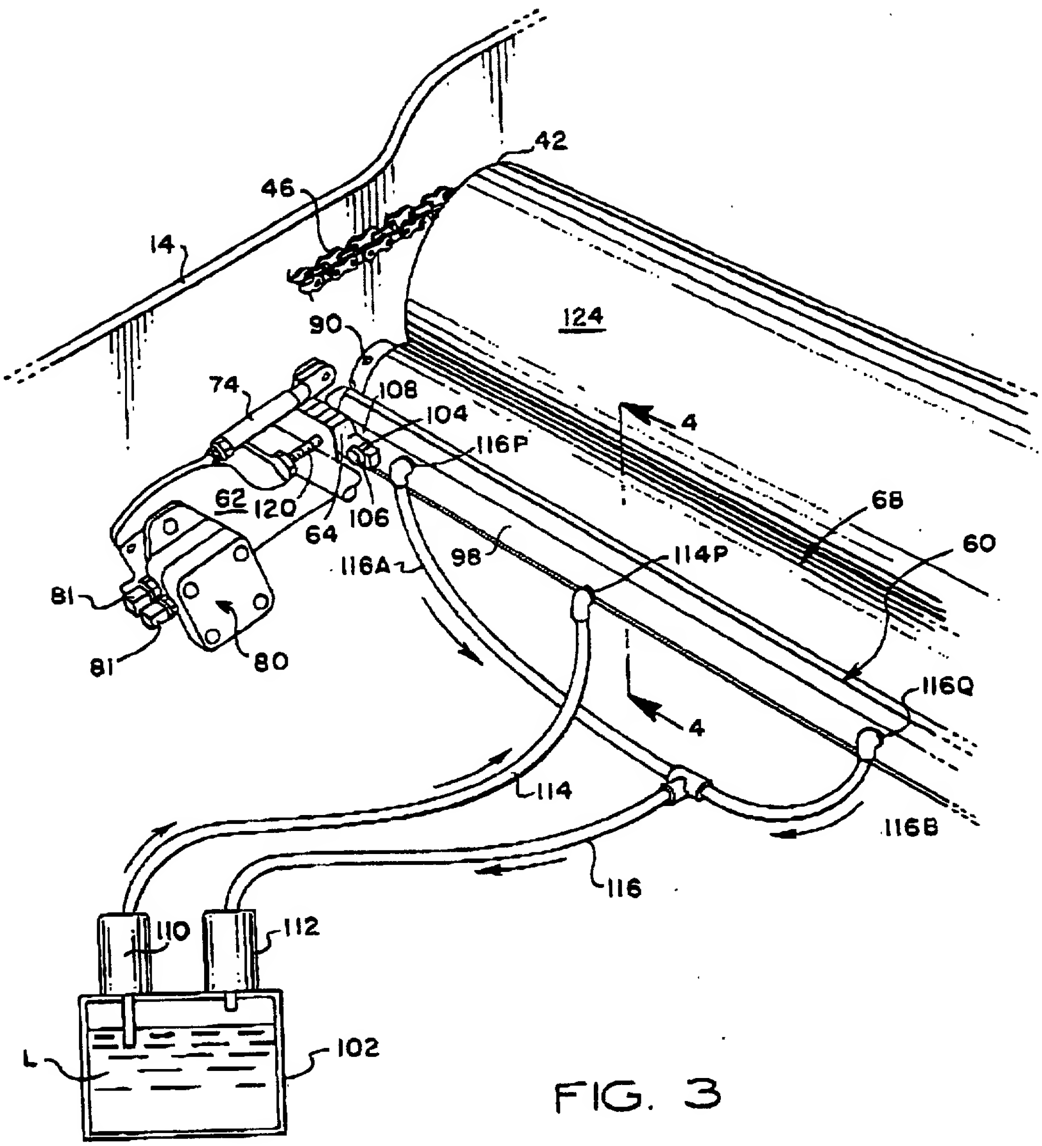
FIG. 2


42
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124
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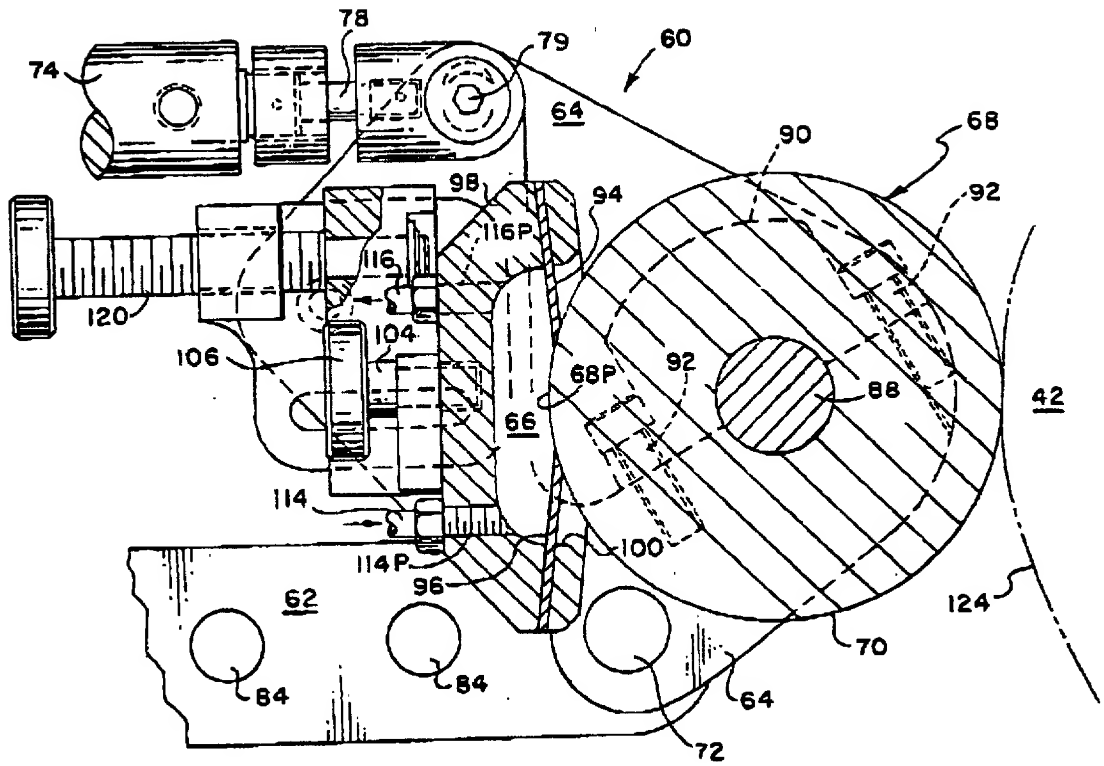
4
116P
68
62
120
106
64
60
116A
98
114P
81
81
80
116Q
4
114
116B
116
110
112
L
102

FIG. 3



78
79
60
74
64
68
90
92
98
94
116P
116
120
104
106
92
88
68P
42
66
114
100
114P
96
124
62
70
84
84
84
64
72

FIG. 4

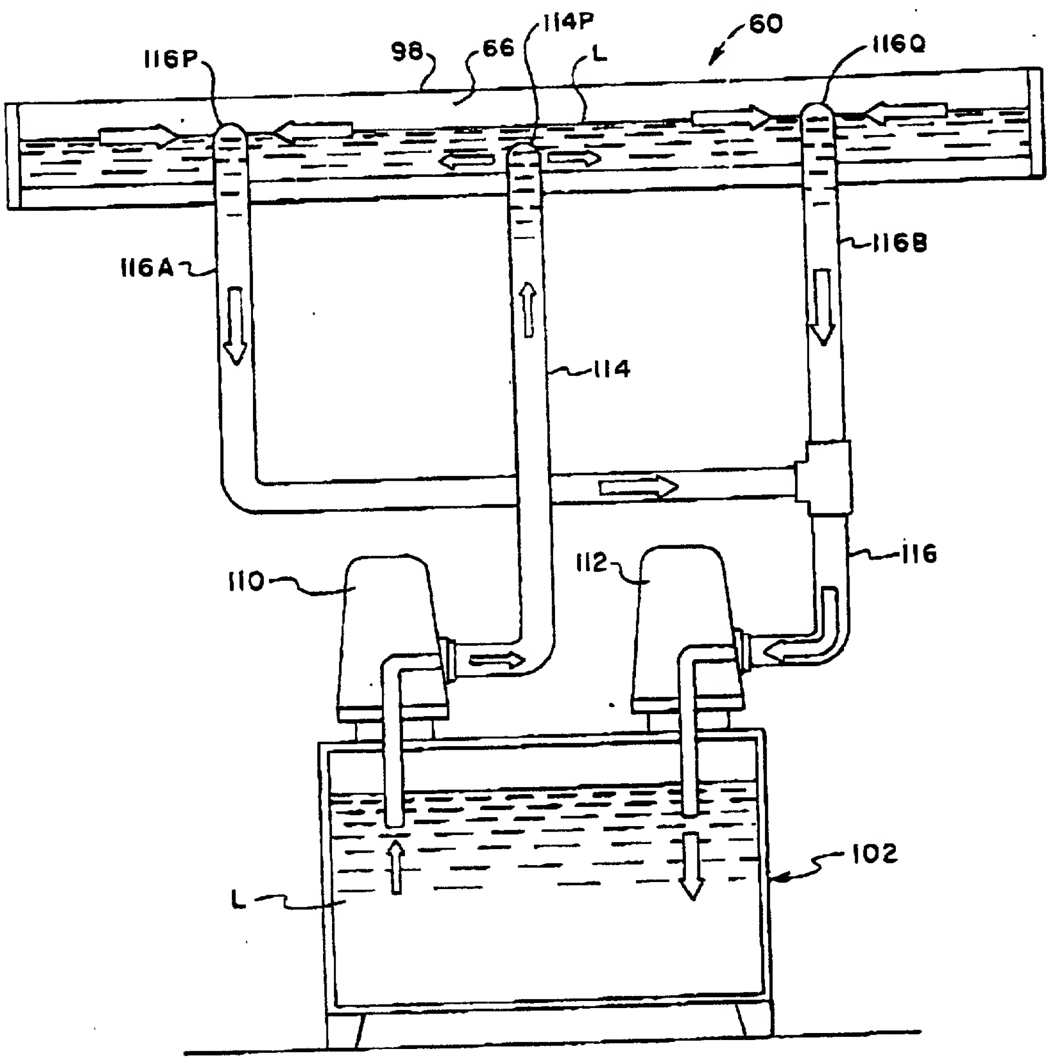


FIG. 5

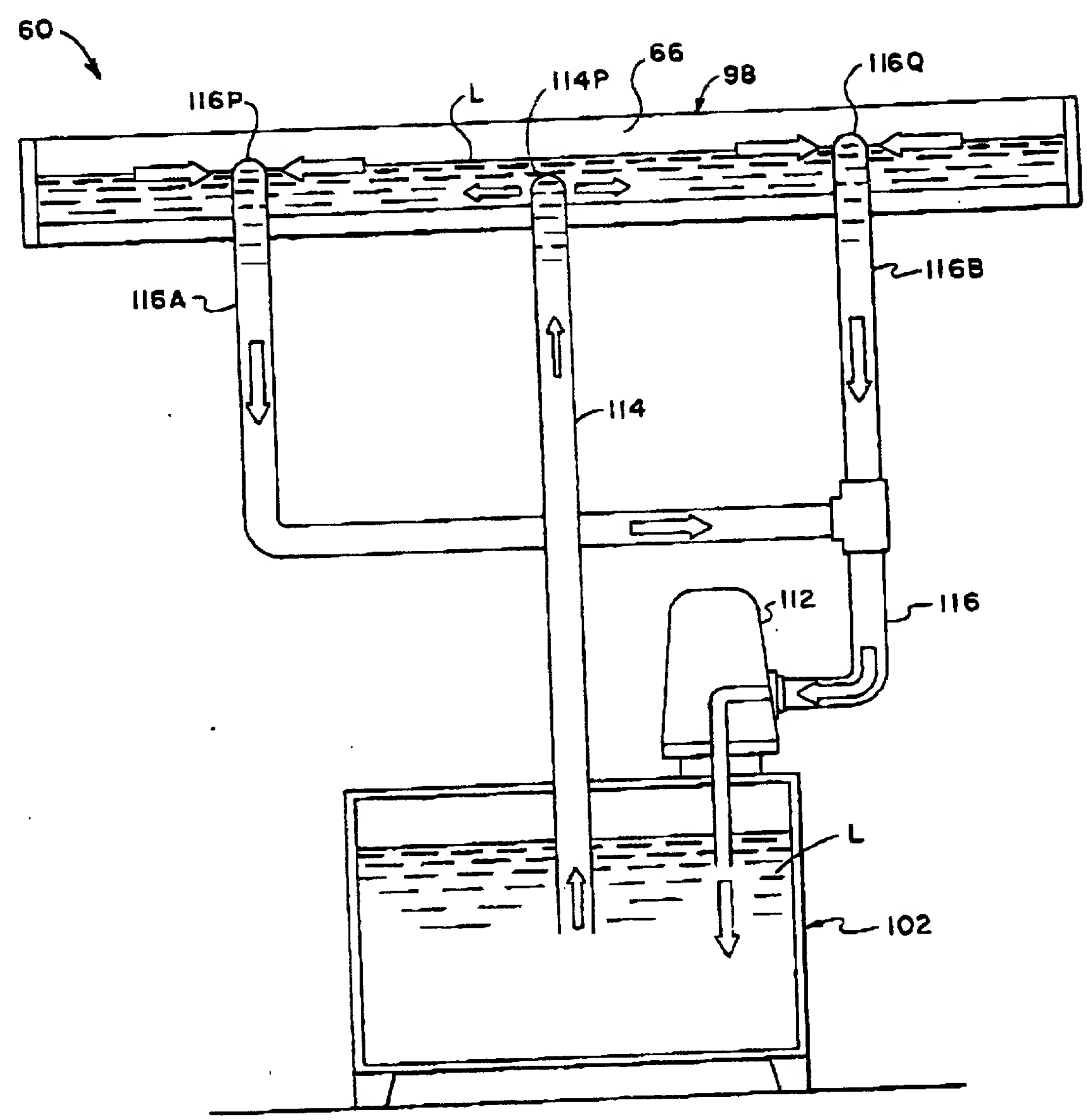


FIG. 6

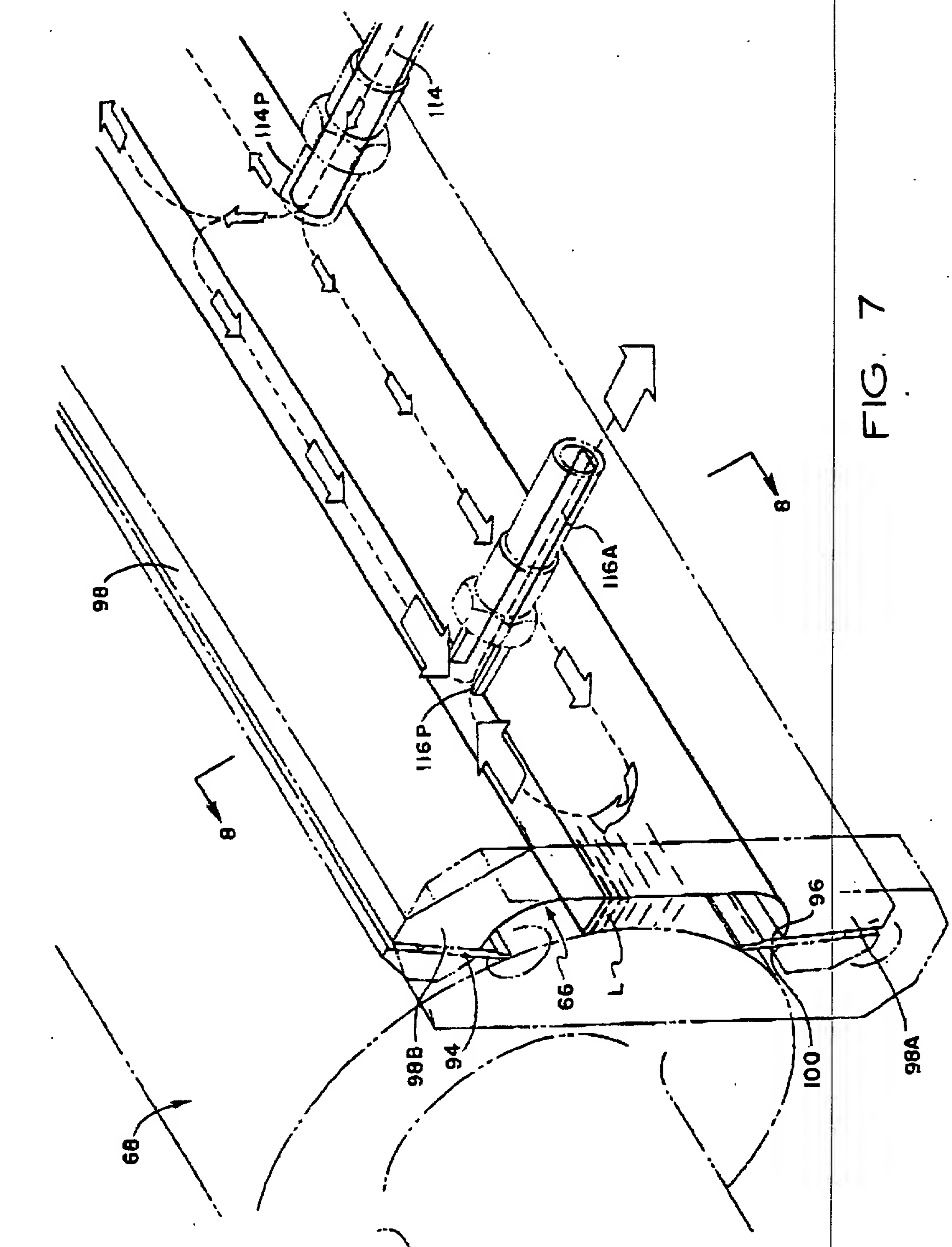


FIG. 7

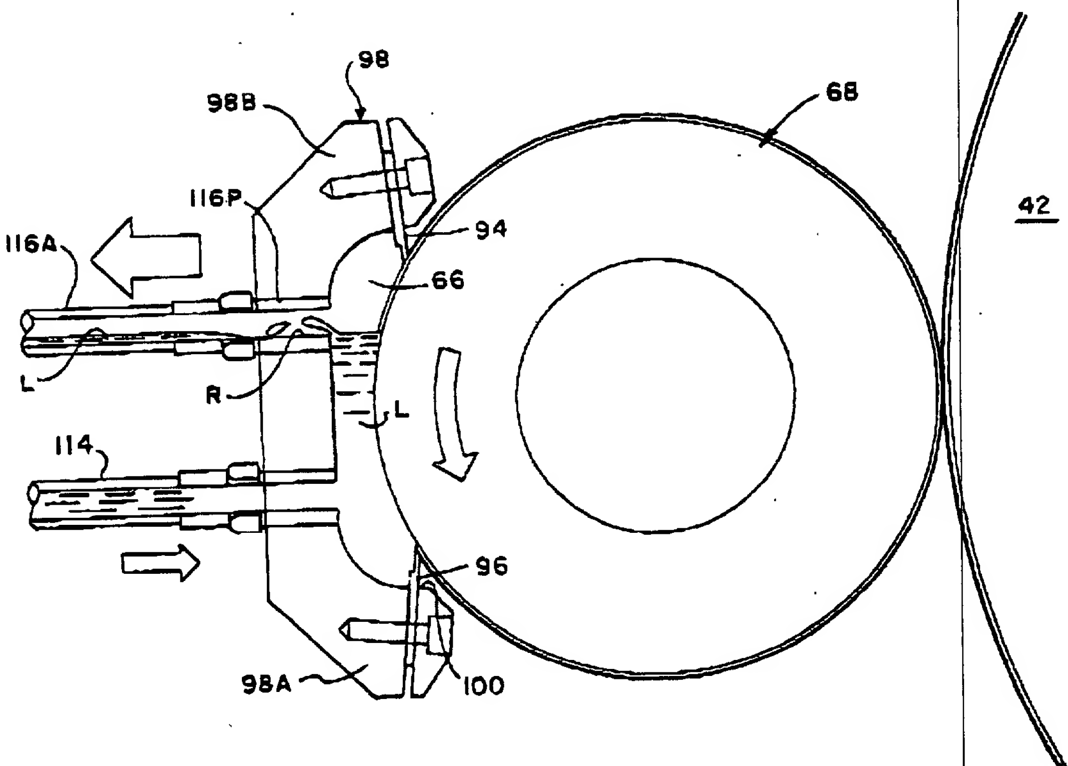
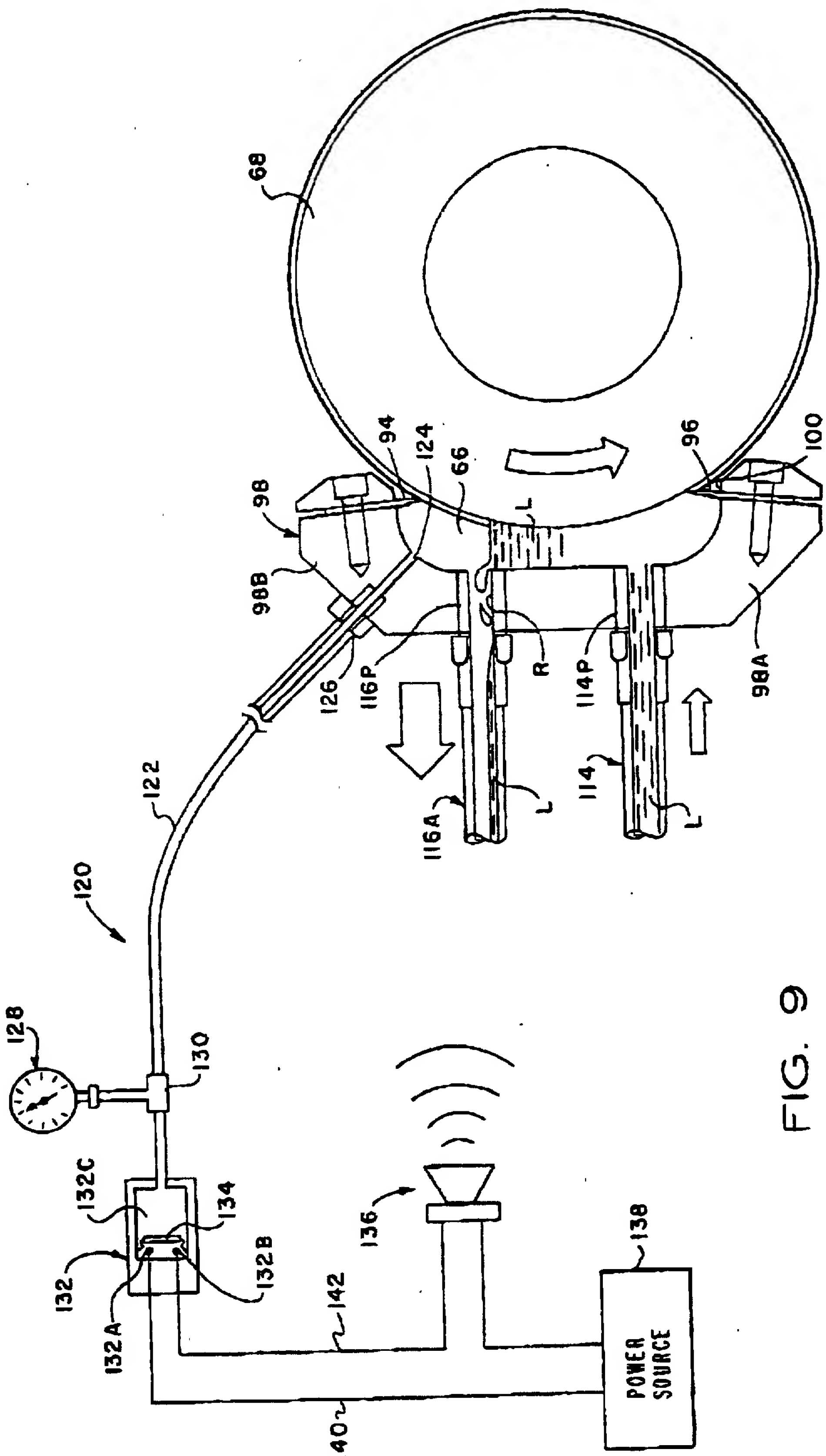


FIG. 8



68
94
124
66
96
100
98
98B
L
116P
R
114P
98A
126
122
116A
114
120
128
130
132C
134
132B
136
138
132
132A
142
140
POWER SOURCE

FIG. 9

COATING APPARATUS FOR SHEET-FED, OFFSET ROTARY PRINTING PRESSES

CROSS REFERENCE TO RELATED APPLICATION

This application is a continuation-in-part of application Ser. No. 07/752,778 filed Aug. 30, 1991.

FIELD OF THE INVENTION

This invention relates to sheet-fed or web-fed, offset rotary or flexographic printing presses, and more particularly, to a new and improved apparatus for the in-line application of protective and decorative coatings or inks to the printed surface of freshly printed sheets or web.

BACKGROUND OF THE INVENTION

Conventional sheet-fed, offset rotary printing presses typically include one or more printing stations through which individual sheets are fed and printed with wet ink. After final printing, the sheets are fed by a delivery conveyor system to the delivery end of the press where the freshly printed sheets are collected and stacked. In a typical sheet-fed, offset rotary printing press such as the Heidelberg Speedmaster line of presses, the delivery conveyor system includes a pair of endless gripper chains carrying spaced laterally disposed gripper bars and grippers which are used to grip and pull freshly printed sheets from the impression cylinder and convey the sheets toward the sheet delivery stacker. The gripper chains are driven in precisely timed relation to the impression cylinder by gripper chain sprocket wheels which are laterally spaced between a delivery drive shaft mounted on opposite sides of the press frame. The delivery drive shaft is mechanically coupled by gears for synchronous rotation with the impression cylinder.

Since the inks used with offset type printing presses typically remain wet and tacky for some time after printing, special precautions must be taken to insure that the wet inked surface of the freshly printed sheets is not marked or smeared as the sheets are transferred from one printing station to another, and through the delivery system to the sheet delivery stacker. The printed surface of the paper dries relatively slowly and can be smeared during subsequent processing, particularly when the printed sheets are stacked. In order to minimize smearing, a dryer may be mounted along the delivery path of the printed sheets, or an anti-offset spray powder may be sprayed on the printed surface.

In some printing applications, it is desirable that the press be capable of applying a protective and/or decorative coating over all or a portion of the surface of the printed sheets. Typical coating solutions include varnish, lacquer, dye, moisturizers and ink. Such coatings typically are formed of a UV-curable or water-soluble resin applied as a liquid solution or emulsion by an applicator roller over the freshly printed sheets to protect the ink and improve the appearance of the sheets. Use of such coatings is particularly desirable when decorative or protective finishes are required such as in the production of posters, record jackets, brochures, magazines, folding cartons and the like. In cases where a liquid coating is to be applied, the coating operation is carried out after the final ink printing has been performed, most desirably by an in-line coating application.

DESCRIPTION OF THE PRIOR ART

Various suggestions have been made for applying the coating as an in-line press operation by using the final printing station of the press as the coating application station. For example, in U.S. Pat. Nos. 4,270,483, 4,685,414 and 4,779,557, there are disclosed coating apparatus which can be moved into position to allow the blanket cylinder of the last printing station of a press to be used to apply a coating material to the sheets. In U.S. Pat. No. 4,796,556, there is disclosed a coating apparatus which can be selectively moved between the blanket cylinder or the plate cylinder of the last printing station of the press so that the station can be used as a coating station for the press.

Suggestions for overcoming the problem of the loss of a printing station when coating is desired have also been made, such as that set forth in U.S. Pat Nos. 4,934,305 which discloses a coating apparatus having a separate timed applicator roller positioned to apply the coating material to the printed sheet while the sheet is on the last impression cylinder of the press. This is said to allow the last printing station to be operated simultaneously as both an ink application station and a coating station so that no loss of press printing unit capability results. Another approach to providing a coating station without losing the printing capabilities of the last printing station is to provide a totally separate coating unit downstream of the last printing station so that the coating is applied to the sheets after final printing and before the sheets have reached the sheet delivery stacker. Such an approach is suggested in U.S. Pat. Nos. 4,399,767 and 4,706,601.

Conventional coating apparatus which is operable as an in-line press operation utilizes an engraved transfer roller, with the liquid coating being applied to the engraved roller by means of a doctor blade assembly. The doctor blade assembly includes an elongated housing having a reservoir chamber extending the length of the transfer roller for holding a volume of coating liquid in wetting contact with the circumferential surface of the transfer roller. A pair of circumferentially spaced doctor blades extend longitudinally along the reservoir housing on either side of the chamber. The doctor blades are angled tangentially toward the transfer roller surface, and seal the reservoir chamber against the roller surface and wipe the roller surface to deposit liquid in the cells of the engraved transfer surface.

The reservoir chamber is pressurized with coating liquid, which is pumped from a remote supply drum into the upper region of the pressure chamber. After the pressure chamber fills to a certain level, it is returned to the remote drum by gravity flow. Occasionally, the doctor blade reservoir chamber becomes completely filled with the coating liquid when the volume of coating liquid being delivered to the doctor blade reservoir chamber exceeds the gravity flow return rate. The positive pressure may cause the seals at the ends of the roller to leak, allowing the coating liquid to drip onto the floor or onto adjacent press parts. Occasionally, the coating liquid may be slung from the roller onto adjacent press equipment and operator areas. Moreover, the buildup of positive pressure within the doctor blade reservoir chamber accelerates the wear of the end seals.

It will be appreciated that the transfer roller may be operated at high speeds, for example, on the order of 1,000 linear feet per minute, and that the end seals of the doctor blade assembly will tend to wear quickly. The

end seal wear is accelerated by the buildup of positive pressure within the doctor blade chamber. Low volume drip leakage can be collected in a drip pan or catch tray, but as the end seals wear, the coating liquid will be slung from the transfer roller, thereby causing a difficult cleanup problem. When this occurs, the press must be shut down, the doctor blade head must be removed, and the end seals replaced. The steps of rebuilding or replacing the end seals and realigning the doctor blade head causes an unacceptable amount of press downtime.

One approach for overcoming the problem of end seal wear is to provide stationary end seals which are mounted on the press frame, and which bear in sealing engagement against the ends of the transfer roller, so that the doctor blade head may form a seal with stationary seals rather than with the dynamic seals carried on the transfer roller. Another approach is to use rotary end seals which include an end plate which is resiliently engaged against the end surface of the transfer roller, with a seal member being secured between the end plate and the end portions of the roller by quick removal mounting lugs.

While the foregoing mechanical approaches to limiting end seal wear and thereby avoiding leakage have been moderately successful, and some arrangements have reduced downtime by quick change mounting features, the end seals nevertheless are still experiencing accelerated wear and early failure, thereby causing frequent replacements and unacceptable downtime for correction of end seal leakage.

OBJECTS OF THE INVENTION

Accordingly, there exists a need for a new and improved in-line coating apparatus for use in a sheet-fed or web-fed, offset rotary or flexographic printing press for applying a protective and/or decorative coating to the printed surface of freshly printed sheets which does not require any expensive or substantial press modification or result in any impairment of normal press operating capability.

Specifically, the principal object of the present invention is to provide a new and improved in-line coating and/or inking apparatus of the character described which achieves a reduction in end seal leakage.

SUMMARY OF THE INVENTION

The present invention provides a new and improved inline doctor blade apparatus for applying a protective and/or decorative coating and/or inking to the surface of freshly printed sheets in a sheet-fed or web-fed, offset rotary or flexographic printing press which is highly reliable and effective in use, yet which does not require any expensive or substantial press modification or result in any impairment of normal press operating capability.

The reservoir of a doctor blade head is supplied with coating material from a remote supply drum. To insure that an adequate supply of coating liquid is always present within the doctor blade reservoir, the coating material is drawn from the remote supply drum and is circulated by suction flow constantly through the reservoir. In contrast to the conventional approach of positively pressurizing the doctor blade reservoir with liquid coating pumped from the remote drum to the reservoir, the coating material is instead circulated through the reservoir by suction flow. That is, instead of charging the reservoir with coating liquid pumped from the remote drum and thereby creating a positive pressure condition within the doctor blade reservoir, circulation through the reservoir is induced by suction flow provided by a suction pump having an input connected for drawing coating liquid from the doctor blade reservoir, and returning it by forced (positive pressure) flow to the remote supply drum, rather than by gravity flow return.

As a result of the suction flow arrangement, the liquid material is drawn from the remote supply drum at a greater rate than the rate of withdrawal of the liquid material by the pickup roller, and a substantially constant supply of liquid material will always be present within the doctor blade reservoir. A benefit of the suction flow arrangement is that a positive pressure buildup does not occur within the doctor blade chamber. Moreover, liquid material which rises above a predetermined fill level is drawn out of the doctor blade reservoir by the suction pump, and is returned to the remote drum. Consequently, the end seals are not subjected to high pressure differential conditions. Instead, the suction flow arrangement produces a negative pressure differential, with the doctor blade chamber being operated at a level below atmospheric. Under negative pressure conditions, leakage of coating liquid is virtually nonexistent, and the operating life of the end seals is substantially increased.

According to another aspect of the present invention, visual and audible alerts are provided by a vacuum sensor line which is coupled to the vacuum space within the doctor blade chamber. The sensor line is coupled to a vacuum gauge which provides a visual indication of the suction pressure within the doctor blade chamber. A vacuum sensor switch is also coupled to the chamber for selectively applying electrical power to an audio transducer when the pressure within the vacuum chamber rises above a predetermined safe operating suction level.

Other features and advantages of the present invention will become more apparent from the following detailed description taken in conjunction with the accompanying drawings which disclose, by way of example, the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic side elevational view of a sheet-fed, offset rotary printing press having a coating apparatus embodying the present invention;

FIG. 2 is an enlarged fragmentary side elevational view taken substantially within the circular area designated "2" in FIG. 1 and showing the coating apparatus of the present invention during coating operation;

FIG. 3 is an enlarged fragmentary perspective view showing one side of the coating apparatus mounted in the press and illustrating the fluid path of coating material from a remote supply drum to the doctor blade reservoir of the coating unit;

FIG. 4 is an enlarged fragmentary sectional view taken substantially along the line 4—4 of FIG. 3;

FIG. 5 is a simplified flow diagram which illustrates a dual pump arrangement for circulating coating liquid from a remote supply drum to the doctor blade reservoir and return;

FIG. 6 is a simplified flow diagram which illustrates a single pump arrangement for circulating coating liquid by suction flow from a remote supply drum to the doctor blade reservoir and return;

FIG. 7 is an enlarged fragmentary perspective view of one end portion of the doctor blade coating apparatus of the present invention;

FIG. 8 is an enlarged sectional view taken substantially along the line 8—8 of FIG. 7; and,

FIG. 9 is a view similar to FIG. 8 which includes a suction pressure sensing circuit for providing a visual indication of suction pressure and an audible alert when the suction/vacuum pressure inside the doctor blade rises above a safe operating level, thereby signaling an impending end seal failure.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

As shown in the exemplary drawings, the present invention is embodied in a new and improved in-line doctor blade apparatus, herein generally designated 10, for use in applying a protective and/or decorative coating or inks to the freshly printed surface of sheets printed in a sheet-fed or web-fed, offset rotary or flexographic printing press, herein generally designated 12. In this instance, as shown in FIG. 1, the doctor blade coating apparatus 10 is illustrated as installed in a four color printing press 12, such as that manufactured by Heidelberger Druckmaschinen AG of the Federal Republic of Germany under its designation Heidelberg Speedmaster 102V (40"), and which includes a press frame 14 coupled at one end, herein the right end, with a sheet feeder 16 from which sheets, herein designated 18, are individually and sequentially fed into the press, and at the opposite end, with a sheet delivery stacker 20 in which the finally printed sheets are collected and stacked. Interposed between the sheet feeder 16 and the sheet delivery stacker 20 are four substantially identical sheet printing stations 22, 24, 26 and 28 which can print different color inks onto the sheets as they are moved through the press 10.

As illustrated, each of the printing stations 22, 24, 26 and 28 is substantially identical and of conventional design, herein including a sheet-fed cylinder 30, a plate cylinder 32, a blanket cylinder 34 and an impression cylinder 36, with each of the first three printing stations 22, 24 and 26 having a transfer cylinder 38 disposed to withdraw the freshly printed sheets from the adjacent impression cylinder and transfer the freshly printed sheets to the next printing station via a transfer drum 40. The final printing station 28 herein is shown as equipped with a delivery cylinder 42 which functions to support the printed sheet 18 as it is moved from the final impression cylinder 36 by a delivery conveyor system, generally designated 44, to the sheet delivery stacker 20.

The delivery conveyor system 44 as shown in FIG. 2 is of conventional design and includes a pair of endless delivery gripper chains 46, only one of which is shown carrying at regular spaced locations along the chains, laterally disposed gripper bars 48 having gripper elements 50 used to grip the leading edge of a sheet 18 after it leaves the nip between the delivery cylinder 42 and impression cylinder 36 of the last printing station 28. As the leading edge E of the sheet 18 is gripped by the grippers 50 the delivery chains 46 pull the sheet away from the impression cylinder 36 and convey the freshly printed sheet to the sheet delivery stacker 20 where the grippers release the finally printed sheet.

The endless delivery chains 46 are driven in synchronous timed relation to the impression cylinder 36 by sprocket wheels 52 fixed adjacent the lateral ends of a delivery drive shaft 54 which has a mechanically geared coupling (not shown) to the press drive system. The delivery drive shaft 54 extends laterally between the sides of the press frame 14 adjacent the impression cylinder 36 of the last printing station 28, and is disposed to be parallel with the axis of the impression cylinder. In this instance, the delivery cylinder 42, which is constructed to allow adjustments in diameter by suitable means, is attached to the delivery drive shaft 54 so that the delivery cylinder is also rotated in precise timed relation with the impression cylinder.

In this respect, it is important to note that when the freshly printed sheets 18 are conveyed away from the impression cylinder 36 of the final printing station 28 by the gripper 50 carried by the delivery chains 46, the wet inked surfaces of the sheets face the delivery drive shaft 54 and the sheets must be supported such that the ink is not smeared as the sheets are transferred. Typically, such support is provided by skeleton wheels or cylinders mounted to the press delivery drive shaft 54, or as is now more commonly used, net equipped delivery cylinders marketed by Printing Research, Inc. of Dallas, Tex. under its registered trademark SUPERBLUE. That system, which is made and sold under license, is manufactured in accordance with and operates as described in U.S. Pat. No. 4,402,267, issued Sep. 6, 1983, to Howard W. DeMoore, the disclosure of which is incorporated herein by this reference.

More recently, vacuum transfer apparatus of the type disclosed in co-pending U.S. application Ser. No. 07/630,308, filed Dec. 18, 1990, entitled "Vacuum Transfer Apparatus for Sheet-Fed Printing Presses", which is also incorporated herein by reference, has been used. The vacuum transfer apparatus disclosed in that application can be used in place of delivery cylinders or skeleton wheels to pull the unprinted side of the sheet away from the delivery drive shaft 54 so that the wet ink surface of the sheets do not come into contact with any press apparatus.

In accordance with the present invention, the in-line doctor blade coating apparatus 10 for applying the protective or decorative coating or ink to the sheets 18 enables the press 12 to be operated in the normal manner without the loss of the final printing station 28, and without requiring any substantial press modifications by employing the existing press delivery drive shaft 54 as the mounting location for the coating applicator roller. In presses having delivery systems such as skeleton wheels mounted on the delivery drive shaft 54 or a vacuum transfer apparatus as disclosed in the aforementioned co-pending U.S. application Ser. No. 07/630,308, conversion to a coating operation can be quickly and easily achieved by mounting on the press delivery drive shaft in place of the skeleton wheels or in addition to the vacuum transfer apparatus, a suitable support cylinder capable of performing the combined function of a coating applicator roller and a net enhanced delivery cylinder 42. By utilizing the delivery cylinder 42 mounted on the delivery drive shaft 54 to also act as a coating applicator roller, protective coating will be applied to the printed sheet 18 in precise timed registration, and will permit the press to be operated with its full range of printing stations.

Toward these ends, the coating apparatus 10 of the present invention includes a relatively simple, positive acting and economical doctor blade coating unit, generally designated 60, mounted to the press frame 14 downstream of the delivery drive shaft 54 and positioned to apply liquid coating material to the support surface of a delivery cylinder 42 mounted on the delivery drive shaft. As can best be seen in FIGS. 2, 3 and 4, the doctor blade coating unit 60 herein comprises a pair of side

frames 62, only one of which is shown, it being understood that the other side frame is substantially the same as that of the side frame illustrated, attached to each side of the press frame 14. Pivotally mounted to one end of each of the side frames 62 is a support bracket 64 carrying one end of a liquid material reservoir 66 and cooperating liquid material pickup roller 68 each disposed to extend laterally across the press 12 parallel with the delivery drive shaft 54. The coating unit 60 is mounted between the upper and lower runs of the delivery chains 46 downstream of the delivery drive shaft 54, and positioned so that the outer peripheral surface 70 of the pickup roller 68 can be engaged with the support surface of a delivery cylinder 42 mounted on the delivery drive shaft.

As best seen in FIGS. 2 and 3, the support bracket 64 is pivotally attached to the end of the side frame 62 by a shaft 72 disposed at the lower end portion of the bracket, and can be pivoted about the shaft by an extensible cylinder 74, herein shown as a pneumatic cylinder, one end 76 of which is secured such as by welding to the side frame, and the opposite end 78 of which is coupled through a pivot shaft 79 to the upper end portion of the bracket. By extending or retracting the cylinder 74, the extent of engagement of the pickup roller 68 against the surface of the applicator roller 42 can be controlled, and the pickup roller can be completely disengaged from the applicator roller 42.

The coating pickup roller 68, which is of conventional design and preferably one such as the Anilox rollers manufactured by A.R.C. International of Charlotte, N.C. and sold under the name "PRINTMASTER" having an engraved ceramic or chrome outer peripheral surface 70, is designed to pick up a predetermined uniform thickness of liquid coating material or ink from the reservoir 66, and then uniformly transfer the coating material to the support surface of the applicator roller 42. To effect rotation of the pickup roller 68, a suitable motor 80, herein a hydraulic motor, is attached to one of the side frames 62 and coupled to a suitable hydraulic fluid source (not shown) through fittings 81A, 81B. Attached to the output of the motor 80 is an output gear which is drivingly coupled through a cluster gear 82 and a series of idler gears 83 each mounted on stub axles 84, to a drive gear 86 attached to the end of a shaft 88 on which the pickup roller 68 is concentrically mounted. The shaft 88 of the pickup roller 68 is, in turn, journaled at each end to the brackets 64 through a releasable semicircular collar 90 attached by bolts 92 to the bracket. Herein, the axle of the terminal idler gear, designated 83', also serves as the shaft 72 for pivotally mounting the support bracket 64 to the side frame 62 so that when the bracket is rotated about the shaft, the terminal idler gear remains engaged with the drive gear 86 of the pickup roller 68.

In this instance, as can best be seen in FIG. 4, the pickup roller 68 has a peripheral surface portion 68P which projects radially into the reservoir 66 containing the supply of coating material or ink. A pair of upper and lower inclined doctor blades 94 and 96 attached to the doctor blade head 98 on shoulders 98A, 98B engage the roller surface to doctor the excess liquid coating material or ink picked up from the reservoir by the engraved surface 70 of the roller. The reservoir cavity 66 herein is formed within an elongated doctor blade head 98 having a generally C-shaped cross-section with an opening 100 extending longitudinally along one side facing the pickup roller 68. The reservoir 66 is supplied

with liquid material or ink from a supply drum 102 disposed in a remote location within or near the press 12. preferably, the doctor blade head 98 is removably attached to the brackets 64, herein by bolts 104 having enlarged, knurled heads 106, and which can be threaded through slots 108 formed in the brackets to clamp the reservoir in place on the brackets.

To insure that an adequate supply of liquid coating material is always present within the reservoir 66 and to prevent coagulation and clogging of the doctor blades 94 and 96 by the liquid coating material or ink, the coating material or ink is circulated through the reservoir by two pumps 110 and 112 as shown in FIG. 5. Pump 110 draws the liquid material L from the supply drum 102 via a supply line 114 and discharges it into a bottom region of the reservoir 66 through a delivery port 114P, and the other pump 112 acts to provide suction to a pair of return lines 116A, 116B coupled adjacent a top region of the reservoir through return ports 116P, 116Q for withdrawing excess liquid coating material or ink from the reservoir. By supplying the coating material or ink from the supply drum 102 at a greater rate than the rate of withdrawal of material by the pickup roller 68, a substantially constant supply of coating material or ink will always be present within the reservoir 66. The excess coating material or ink which rises above the liquid level of the return port R (FIG. 8) is suctioned away by the suction return pump 112.

The general arrangement of the pickup roller 68, doctor blades 94 and 96, and reservoir 66 is similar to that disclosed in U.S. Pat. No. 4,821,672 entitled "Doctor Blade Assembly With Rotary End Seals and Interchangeable Heads", the disclosure of which provides details concerning the end seal structure and operation of a pickup roller and reservoir usable with the present invention. According to an important feature of the present invention, however, the doctor blade reservoir 66 is not pressurized as taught by the prior art. Instead, coating liquid or ink is supplied to the doctor blade reservoir 66 by the suction flow produced by the pump 112. In this arrangement, the suction pump 112 applies a vacuum or suction force in the reservoir which draws liquid material L from the supply through the supply conduit 114 to the reservoir and draws excess liquid material L from the doctor blade reservoir 66 through the return conduit 116 into the remote reservoir 102 at a rate which is greater than the rate that liquid coating material or ink is being supplied to the doctor blade reservoir through the supply conduit 114. Because the suction return flow rate is greater than the supply flow rate, a positive pressure condition within the doctor blade reservoir is avoided, and a below atmospheric vacuum pressure level is provided.

Referring to FIG. 5, FIG. 6, FIG. 7 and FIG. 8, the liquid material is delivered into the lower region of the doctor blade reservoir 66, and is withdrawn from the doctor blade reservoir near an upper region of the chamber through the return conduits 116A, 16B. The liquid level elevation of the return port is preferably selected to provide for the accumulation of liquid coating material or ink in more than about half of the doctor blade chamber, thereby insuring that the engraved surface of the pickup roller 68 will be thoroughly wetted by the coating material or ink L as it turns through the doctor blade chamber 66. The reservoir 66 is bounded vertically by lower and upper doctor head shoulders 98A, 98B. Accordingly, the return ports 116P, 116Q of return lines 116A, 116B are located at a liquid level R

intermediate the limits established by the lower and upper shoulders. Any excess liquid coating material or ink which rises above the liquid level R of the return ports will be suctioned away by the pump 112.

It will be appreciated that the supply pump 110 is optional, and that the suction circulation system can be operated effectively with only the single suction pump 112 as shown in FIG. 6. In the single pump configuration, it may be necessary to prime the supply conduit 114 to obtain satisfactory operation. The two pump arrangement as shown in FIG. 5 is preferred for those installations in which the supply drum 102 is located at a distance that is too far from the press to achieve adequate suction flow. The auxiliary supply pump 110 provides positive flow input to the doctor blade reservoir at a fixed flow rate. The return suction pump 112 has a faster suction flow rate than the supply flow rate. Consequently, a positive pressure buildup in the doctor blade reservoir cannot occur. By utilizing two pumps as shown in FIG. 5, the liquid level within the doctor blade chamber 66 can be closely controlled, without positive pressure buildup, thereby reducing leakage through the end seals.

Referring to FIG. 8, it will be appreciated that the doctor blade chamber 66 is maintained at a pressure level below atmospheric by the suction action of the return flow pump 112. The coating liquid L rises to the liquid level of the return port R and is drawn off immediately by the suction pump 112. Additionally, air within the doctor blade chamber 66 is also evacuated, thereby reducing the doctor blade chamber pressure to a level below atmospheric. This negative pressure differential condition opposes leakage of coating liquid L through the end seals. Since the doctor blade chamber 66 is not positively pressurized, the end seals are operated under favorable pressure differential conditions, thereby extending their useful lifetime. Moreover, the negative pressure differential doctor blade assembly will accommodate a pickup roller having a chipped corner, which would leak under positive pressure conditions, but does not leak because of the negative pressure reservoir condition established by suction flow.

It is useful for the press operator to have an advance warning of an impending end seal failure. With advance warning, the press operator can schedule repair and/or replacement of the doctor blades and the end seals at a convenient time, for example between press runs or before undertaking the next printing job. Apparatus for monitoring the suction/vacuum condition within the doctor blade chamber 66 is provided by a pneumatic sensor circuit 120 as shown in FIG. 9. The pneumatic sensor circuit 120 includes a pneumatic sensor line 122 which is coupled in fluid communication with the doctor blade chamber 66 through a vacuum sensor bore 124 formed through the upper doctor head shoulder 98B. The vacuum sensor line 122 is coupled to the sensor bore 124 by a threaded fitting 126.

Continuous monitoring of the vacuum/suction condition within the doctor blade chamber 66 is provided by a vacuum gauge 128 which can be of any conventional design, for example a Bourdon gauge which is calibrated for dry air and covers the range from about zero to about twenty torrs. The vacuum gauge 128 is coupled into the sensor line 122 by a tee coupling 130. According to this arrangement, the press operator receives a continuous visual indication of the vacuum/suction condition within the doctor blade chamber 66.

According to another feature of the invention, the vacuum/suction line 122 is coupled to a vacuum switch 132. The vacuum switch 132 has a conductive, movable diaphragm 134 which moves into and out of electrical contact with switch electrodes 132A, 132B. That is, the diaphragm 134 is pulled out of contacting engagement with the switch electrodes 132A, 132B when the vacuum/suction level in the doctor blade chamber 66 is below a predetermined level. When the pressure level within the doctor blade chamber 66 rises above that preset level, for example in response to leakage of air through the end seals or around a worn doctor blade 94, the vacuum force within the vacuum chamber 132C of the sensor switch also rises, thereby permitting the conductive switch element 134 to engage the switch electrodes 132A, 132B.

When switch closure occurs, electrical power is applied to an audio transducer 136 from a power source 138. Electrical current is conducted through the pneumatic switch 132 to the audio transducer 136 through power conductors 140, 142. According to this arrangement, the press operator will receive an audible alert as soon as the suction/vacuum pressure in the doctor blade chamber rises above a safe operating level, thereby signaling wear failure of the doctor blades and/or an impending failure of the end seals.

From the foregoing, it should be apparent that the coating apparatus 10 of the present invention provides a highly reliable, effective and economical in-line apparatus for applying coating material to the freshly printed sheets 18 in a sheet-fed, offset rotary printing press 12 which allows the final printing station to continue to be used as a print station, yet which does not require any substantial press modification or the addition of a separate timed applicator roller. While a particular form of the present invention has been illustrated and described, it should be apparent that variations and modifications therein can be made without departing from the spirit and scope of the invention.

What is claimed is:

1. Apparatus for applying liquid material from a supply to a pickup roller comprising in combination:

a doctor blade head having an elongated reservoir for receiving liquid material from the supply, said doctor blade head being adapted to extend in parallel with the pickup roller in an operative position with a portion of the peripheral surface of the pickup roller extending into said reservoir for wetting contact with liquid material contained therein, and two doctor blades attached to said doctor blade head for engagement against said peripheral surface in the operative position;

a supply conduit connecting said supply in flow communication with said reservoir;

a return conduit connecting said reservoir in flow communication with said supply; and,

a first pump coupled in series flow relation with said return conduit for inducing suction flow of liquid material from said reservoir through said return conduit into said supply.

2. Apparatus as defined in claim 1, including:

a second pump coupled in series flow relation with said supply conduit for pumping liquid material from said supply to said reservoir.

3. Apparatus as defined in claim 2, wherein the suction return pumping rate of said first pump is greater than the supply pumping rate of said second pump.

4. Apparatus as defined in claim 1, said doctor blade head having first and second shoulders forming lower and upper liquid level boundaries for said reservoir, respectively, wherein the return conduit is coupled in flow communication with said reservoir at a liquid level location disposed intermediate the liquid level boundaries established by said first and second shoulders.

5. Apparatus as defined in claim 1, wherein the return conduit is coupled in flow communication with said reservoir at a first liquid level location and the supply conduit is coupled in flow communication with said reservoir at a second liquid level location, the first liquid level location of the return conduit being higher in elevation than the second liquid level location of the supply conduit when the doctor blade head is in the operative position.

6. Apparatus for applying liquid material from a supply to a pickup roller comprising, in combination:

an elongated doctor blade head having an elongated cavity formed therein defining a reservoir for receiving liquid material from the supply, said doctor blade head being adapted to extend in parallel with the pickup roller in an operative position with a portion of the peripheral surface of the pickup roller extending into said cavity for wetting contact with liquid material contained therein, and a pair of doctor blades disposed on opposite sides of said cavity and extending the length thereof for engagement against the peripheral surface of the pickup roller in the operative position; and,

means coupled to said supply and to said reservoir for inducing flow of liquid material from said supply into said reservoir and for returning excess liquid material by suction force from said reservoir to said supply.

7. Apparatus as defined in claim 6, said inducing means comprising:

a supply conduit connecting said supply in flow communication with said reservoir;

a return conduit connecting said reservoir in flow communication with said supply; and,

a first pump coupled in series flow relation with said return conduit for inducing suction flow of liquid material from said supply through said supply conduit into said reservoir, and for inducing suction flow of liquid material from said reservoir through said return conduit into said supply.

8. Apparatus as defined in claim 7, said means including:

a second pump coupled in series flow relation with said supply conduit for pumping liquid material from said supply to said reservoir.

9. Apparatus as defined in claim 8, wherein the suction return pumping rate of said first pump is greater than the supply pumping rate of said second pump.

10. Apparatus as defined in claim 6, said doctor blade head having first and second shoulders forming lower and upper liquid level boundaries for said reservoir, respectively, wherein said means for inducing suction flow includes a return conduit coupled in flow communication with said reservoir at a liquid level location disposed intermediate the liquid level boundaries established by said first and second shoulders.

11. Apparatus for applying liquid material from a supply to a pickup roller comprising in combination:

a doctor blade head having an elongated reservoir for receiving liquid material from the supply, said doctor blade head being adapted to extend in parallel with the pickup roller in an operative position with a portion of the peripheral surface of the pickup roller extending into said reservoir for wetting contact with liquid material contained therein, and two doctor blades attached to said doctor blade head for engagement against said peripheral surface in the operative position;

first means coupled to said supply and to said reservoir for pumping liquid material from said supply into said reservoir; and,

second means coupled to said reservoir and to said supply for inducing suction flow of liquid material from said reservoir into said supply.

12. Apparatus for applying liquid material from a supply to a pickup roller comprising in combination:

a doctor blade head having an elongated reservoir chamber for receiving liquid material from the supply, said doctor blade head being adapted to extend in parallel with the pickup roller in an operative position with a portion of the peripheral surface of the pickup roller extending into said reservoir chamber for wetting contact with liquid material contained therein, and two doctor blades attached to said doctor blade head for engagement against said peripheral surface in the operative position; and,

a suction pump coupled to said reservoir and to said supply for inducing suction flow of liquid material from said reservoir to said supply.

13. Apparatus as defined in claim 12, including a pneumatic sensor conduit coupled to said reservoir chamber for sensing the air vacuum pressure within said reservoir chamber, and a vacuum gauge coupled to said sensor conduit for providing a visual indication of air vacuum pressure in said reservoir chamber.

14. Apparatus as defined in claim 12, including a pneumatic sensor conduit coupled to said reservoir chamber for sensing the air vacuum pressure within said reservoir chamber, a vacuum responsive switch having a sensing chamber coupled to said sensor conduit and switch electrodes and an audio transducer electrically connected to said switch electrodes for making and breaking an electrical circuit from a power source to said audio transducer.

15. In a sheet-fed, offset rotary printing press of the type including at least one printing station having a blanket cylinder and an impression cylinder disposed for printing ink onto sheets passing therebetween, and a delivery conveyor system for pulling freshly printed sheets from the impression cylinder and transporting the printed sheets toward a sheet delivery stacker, the delivery conveyor system including a delivery drive shaft disposed adjacent to and extending parallel with the impression cylinder and driven in timed synchronous relation with the impression cylinder, the improvement comprising:

a delivery cylinder mounted onto said delivery drive shaft and having an outer peripheral support surface adapted to engage and support a sheet being transported by said delivery conveyor system;

a coating apparatus including a supply of liquid material, a rotatable pickup roller having an outer peripheral surface of substantially cylindrical shape, and means for applying a coating of liquid material from said supply onto said outer peripheral surface of said pickup roller;

means for mounting said coating apparatus to the press adjacent said delivery cylinder with a portion

of said peripheral surface of said pickup roller engaged with the support surface of said delivery cylinder, whereby liquid coating material from said supply applied onto the peripheral surface of said pickup roller is transferred to said support surface of said delivery cylinder and to said freshly printed sheet;

said coating apparatus including an elongated reservoir for receiving liquid material from said supply, said reservoir extending parallel with said pickup roller with a portion of the peripheral surface of the pickup roller extending into said reservoir for wetting contact with liquid material contained therein, and two doctor blades attached to said reservoir and engaging said peripheral surface, said doctor blades acting to limit the amount of liquid material applied onto said peripheral surface from said reservoir;

a supply conduit connecting said supply in flow communication with said reservoir;

a return conduit connecting said reservoir in flow communication with said supply; and,

a first pump coupled in series flow relation with said return conduit for inducing suction flow return of liquid material from said reservoir to the remote supply.

16. The improvement as set forth in claim 15, wherein said coating apparatus is mounted to said press downstream of said delivery drive shaft in the direction of travel of said sheets during transport by said delivery conveyor system.

17. The improvement as set forth in claim 15, including:

a second pump coupled in series flow relation with said supply conduit for liquid material from the remote supply to said reservoir.

18. The improvement as set forth in claim 17, wherein the suction return flow rate of said first pump is greater than the positive pressure supply flow rate of said second pump.

19. The improvement as set forth in claim 15, wherein the return conduit is coupled in flow communication with said reservoir at a first liquid level location and the supply conduit is coupled in flow communication with said reservoir at a second liquid level location, the first liquid level location of the return conduit being higher than the second liquid level location of the supply conduit.

20. In a sheet-fed, offset rotary printing press of the type including at least one printing station having a blanket cylinder and an impression cylinder disposed for printing wet ink onto sheets passing therebetween, and a delivery conveyor system for pulling freshly printed sheets from the impression cylinder and transporting the printed sheets toward a sheet delivery stacker, the delivery conveyor system comprising a pair of endless gripper chains disposed on opposite sides of the press and supporting therebetween gripper bars and grippers spaced along the chains, the gripper chains being driven in timed synchronous relation with the impression cylinder by laterally spaced sprocket wheels mounted on opposite ends of a delivery drive shaft disposed adjacent to and extending parallel with the impression cylinder, the improvement comprising:

a delivery cylinder mounted to said delivery drive shaft between said sprocket wheels and having an outer peripheral support surface covered by a removable coating blanket adapted to engage and support the wet ink side of a sheet being transported by said gripper bars;

a coating apparatus including a supply of liquid material, a rotatable pickup roller having an outer peripheral surface of substantially cylindrical shape, and means for applying liquid material from said supply onto said peripheral surface of said pickup roller;

means for mounting said coating apparatus to the press adjacent the delivery cylinder, with a portion of the outer peripheral surface of said pickup roller engaged with said delivery cylinder, whereby liquid material doctored onto the peripheral surface of said pickup roller is transferred to said delivery cylinder and to said freshly printed sheet;

said coating apparatus including an elongated reservoir containing liquid material, said reservoir being disposed to extend parallel with said pickup roller with a portion of said peripheral surface extending into said reservoir in contact with liquid material contained therein, and two doctor blades attached to said reservoir and engaging said peripheral surface, said doctor blades acting to limit the amount of liquid coating material applied onto said peripheral surface from said reservoir;

a supply conduit connecting said supply in flow communication with said reservoir;

a return conduit connecting said reservoir in flow communication with said supply; and,

a first pump coupled in series flow relation with said return conduit for inducing suction flow return of liquid material from said reservoir to said supply.

21. A sheet-fed, offset rotary printing press including:

at least one printing station having a blanket cylinder and an impression cylinder disposed for printing wet ink onto sheets passing therebetween;

a delivery conveyor system for pulling freshly printed sheets from the impression cylinder and transporting the printed sheets toward a sheet delivery stacker, the delivery system including a delivery drive shaft;

a delivery cylinder mounted to said delivery drive shaft and having an outer peripheral support surface adapted to engage and support a sheet being transported by said delivery conveyor system;

a coating apparatus including a supply of liquid material, a rotatable pickup roller having an outer peripheral surface of substantially cylindrical shape, and means for applying liquid material from said supply onto the peripheral surface of said pickup roller;

means for mounting said coating apparatus to the press adjacent said delivery cylinder, with a portion of said peripheral surface of said pickup roller engaged with said delivery cylinder, whereby liquid material applied to the peripheral surface of said pickup roller is transferred to said delivery cylinder and then to said freshly printed sheet;

said coating apparatus including an elongated reservoir containing liquid material, said reservoir being disposed to extend parallel with said pickup roller with a portion of said peripheral surface extending into the reservoir in contact with liquid material contained therein, and two doctor blades attached to said reservoir and engaging said peripheral surface, said doctor blades acting to limit the amount of liquid coating material applied onto said peripheral surface from said reservoir;

a supply conduit connecting said supply in flow communication with said reservoir;

a return conduit connecting said reservoir in flow communication with said supply; and,

a first pump coupled in series flow relation with said return conduit for inducing suction flow return of liquid material from said reservoir to said supply.

* * * * *

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US005335596A

United States Patent [19]

DeMoore et al.

[11] Patent Number: 5,335,596

[45] Date of Patent: * Aug. 9, 1994

[54] COATING APPARATUS FOR SHEET-FED, OFFSET ROTARY PRINTING PRESSES

[75] Inventors: Howard W. DeMoore, 10954 Shady Trail, Dallas, Tex. 75220; Steven M. Person, Seagoville, Tex.

[73] Assignee: Howard W. DeMoore, Dallas, Tex.

[*] Notice: The portion of the term of this patent subsequent to May 4, 2010 has been disclaimed.

[21] Appl. No.: 52,763

[22] Filed: Apr. 26, 1993

Related U.S. Application Data

[63] Continuation of Ser. No. 879,841, May 6, 1992, Pat. No. 5,207,159, which is a continuation-in-part of Ser. No. 752,778, Aug. 30, 1991, Pat. No. 5,176,077.

[51] Int. Cl.[5] B41F 31/00

[52] U.S. Cl. 101/350; 101/351; 101/367; 101/147; 118/261

[58] Field of Search 101/350, 351, 352, 137, 101/147, 148, 157, 167, 169, 207, 208, 219, 329, 330, 331, 348, 349, 364, 365, 366, 367; 118/602, 612, 236, 242, 259, 261, 262

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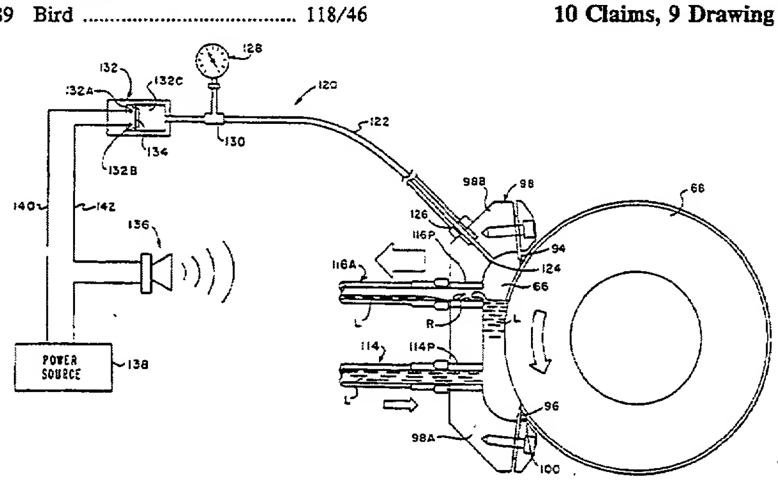
Primary Examiner—Eugene H. Eickholt

Attorney, Agent, or Firm—Dennis T. Griggs

[57] ABSTRACT

A coating apparatus for use in a sheet-fed or web-fed, offset rotary or flexographic printing press to apply a protective and/or decorative coating to the surface of freshly printed sheets includes a doctor blade coating unit coupled to a pickup roller for supplying liquid material from a reservoir to the surface of a pickup roller mounted on a press delivery drive shaft. Liquid material is circulated through the reservoir of the doctor blade unit by suction flow produced by a return pump. This prevents the buildup of a positive pressure differential within the doctor blade reservoir. The doctor blade reservoir is maintained at below ambient pressure level, thereby preventing leakage through the end seals. A vacuum sensor circuit provides a visual indication of air vacuum pressure in the doctor blade reservoir chamber, and a vacuum sensor switch applies electrical power to an audio transducer. The audio transducer produces an audible alarm in response to an increase in doctor blade chamber pressure, thereby providing advance warning of an impending end seal failure or a worn doctor blade condition.

10 Claims, 9 Drawing Sheets



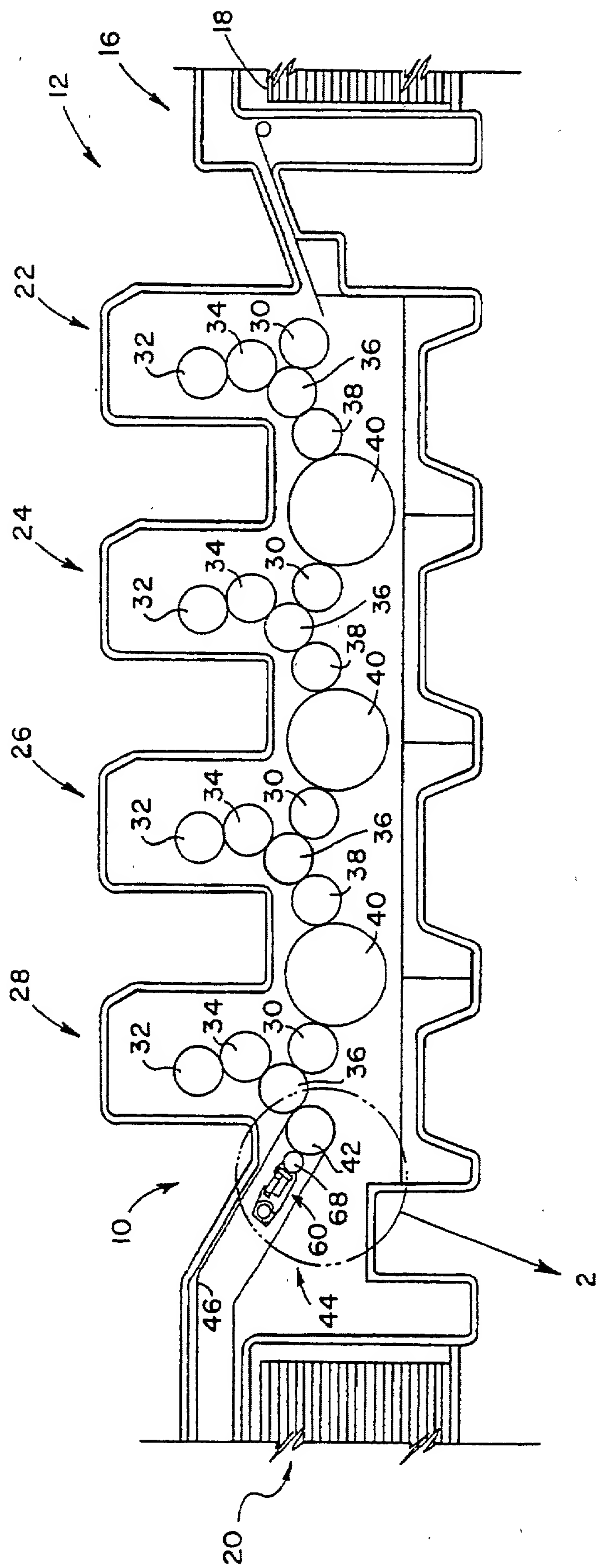


FIG. 1

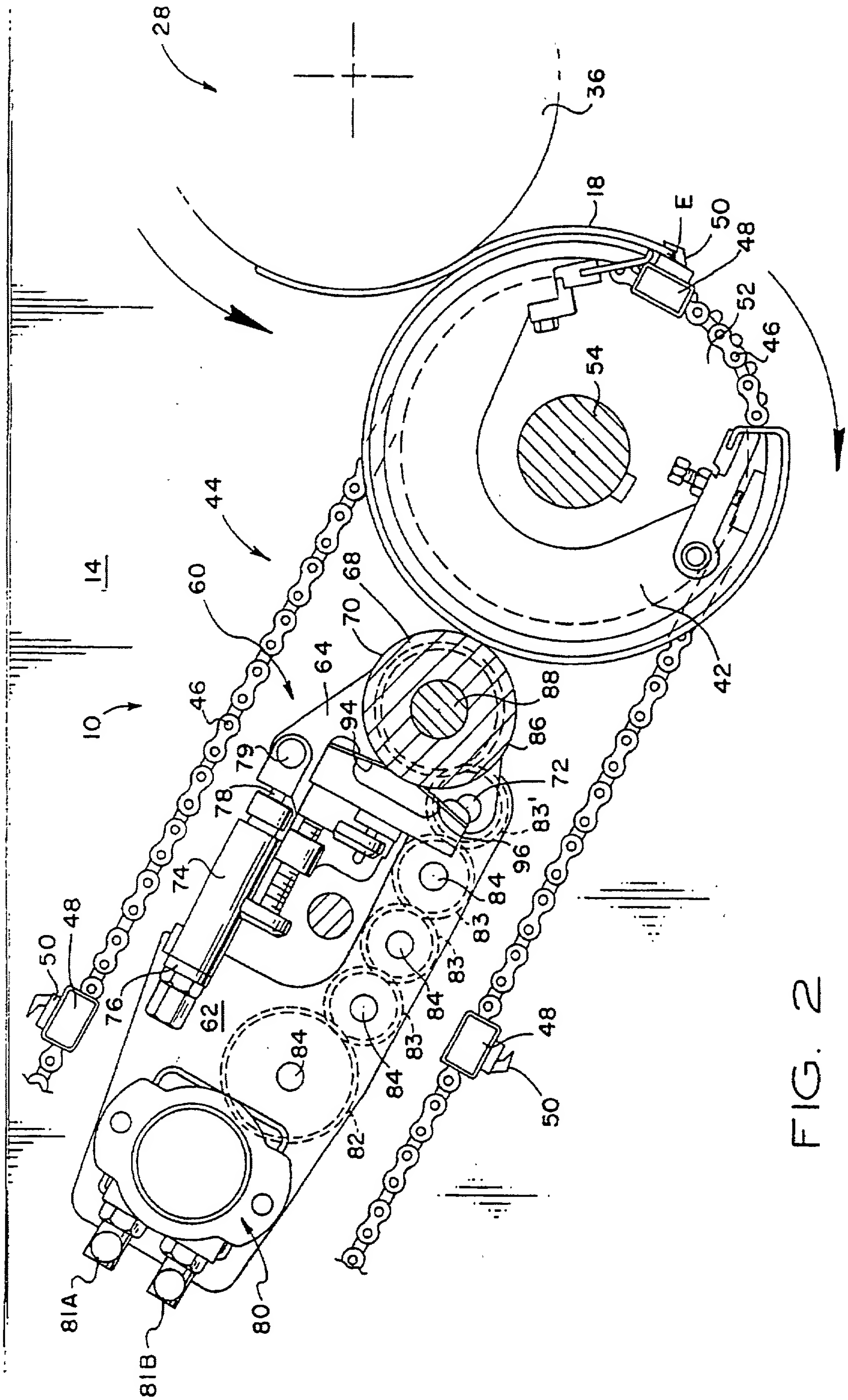

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FIG. 2

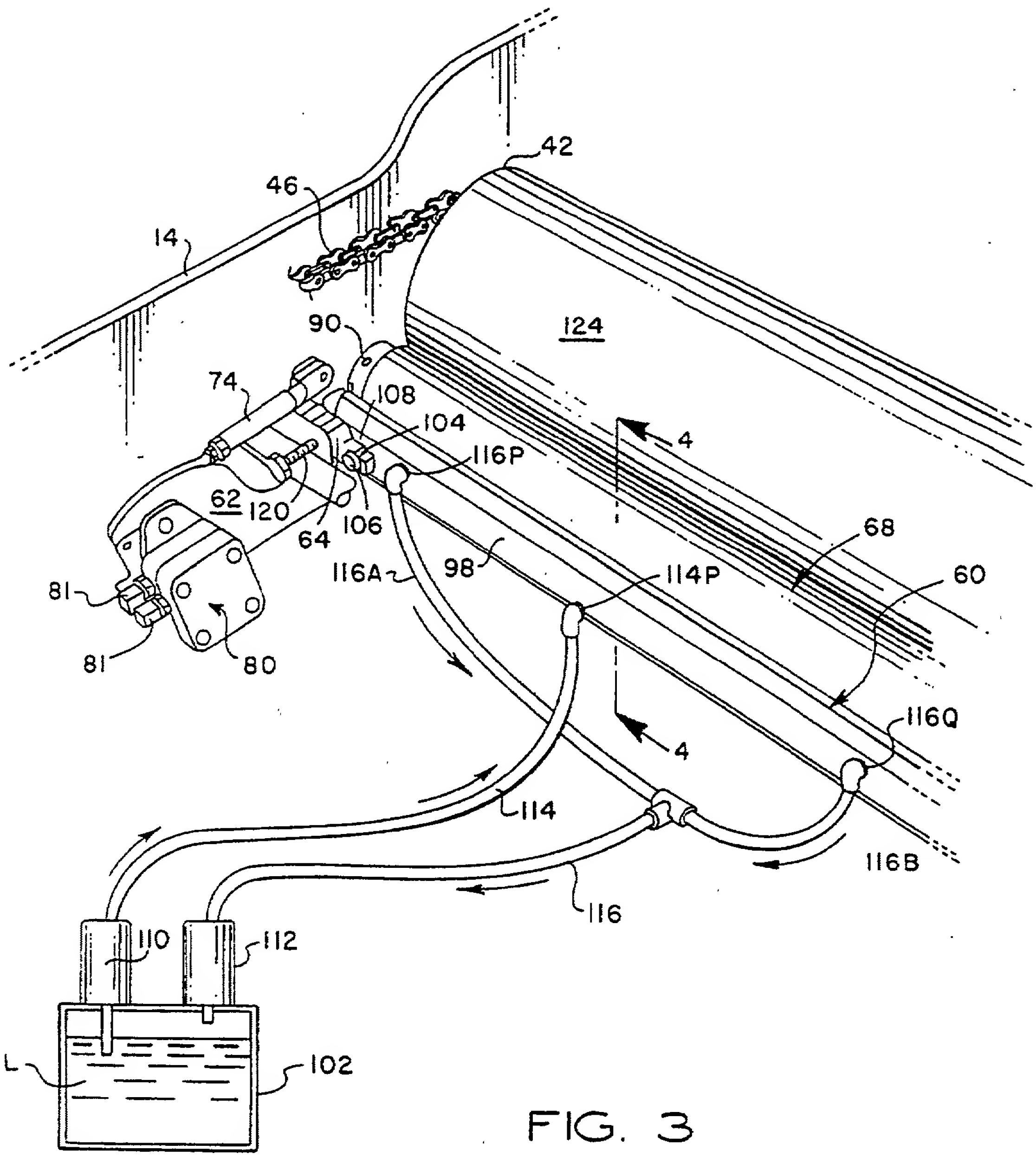

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FIG. 3

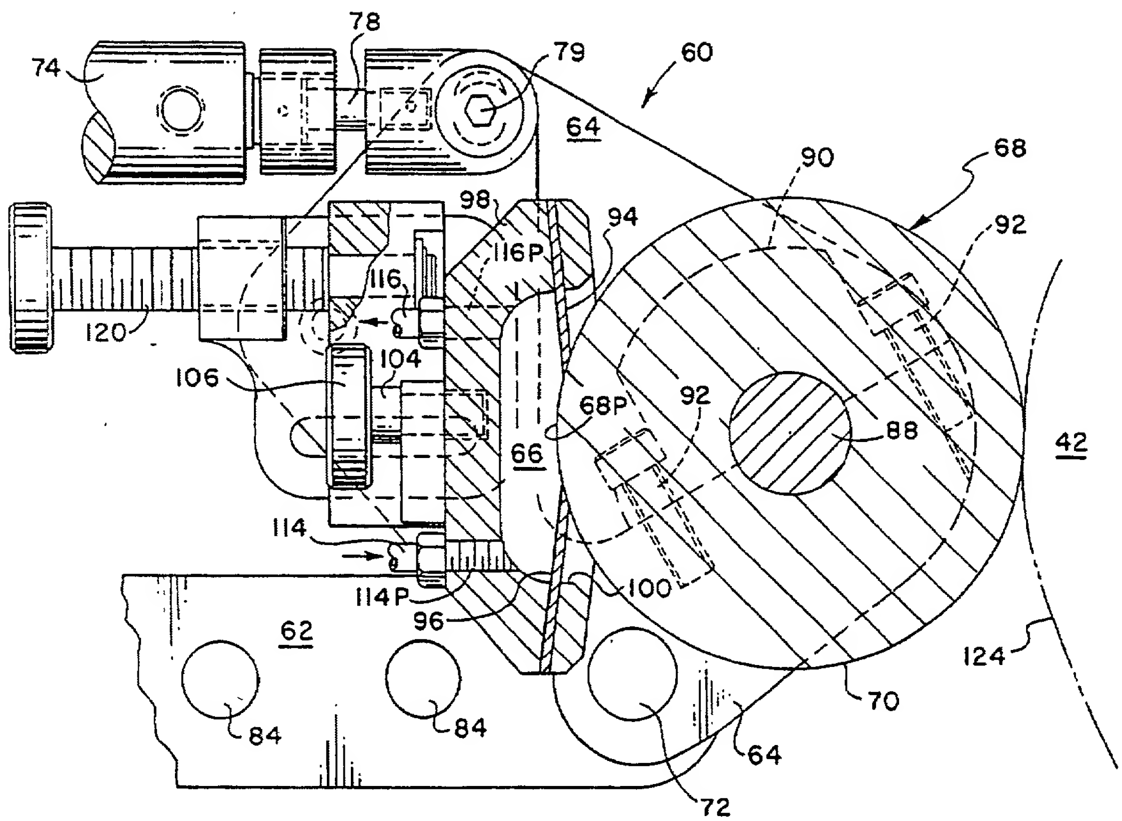

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FIG. 4

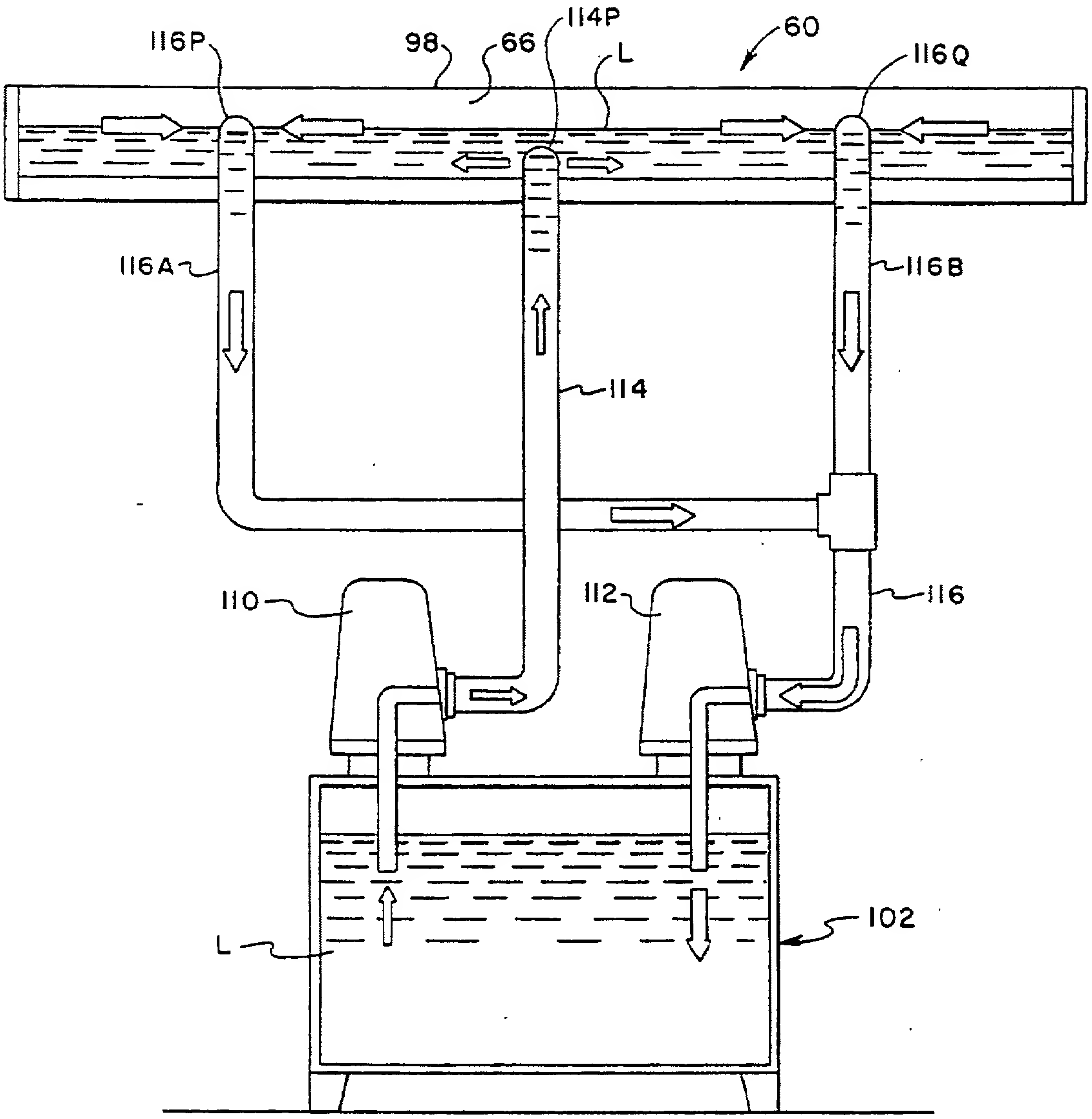


FIG. 5

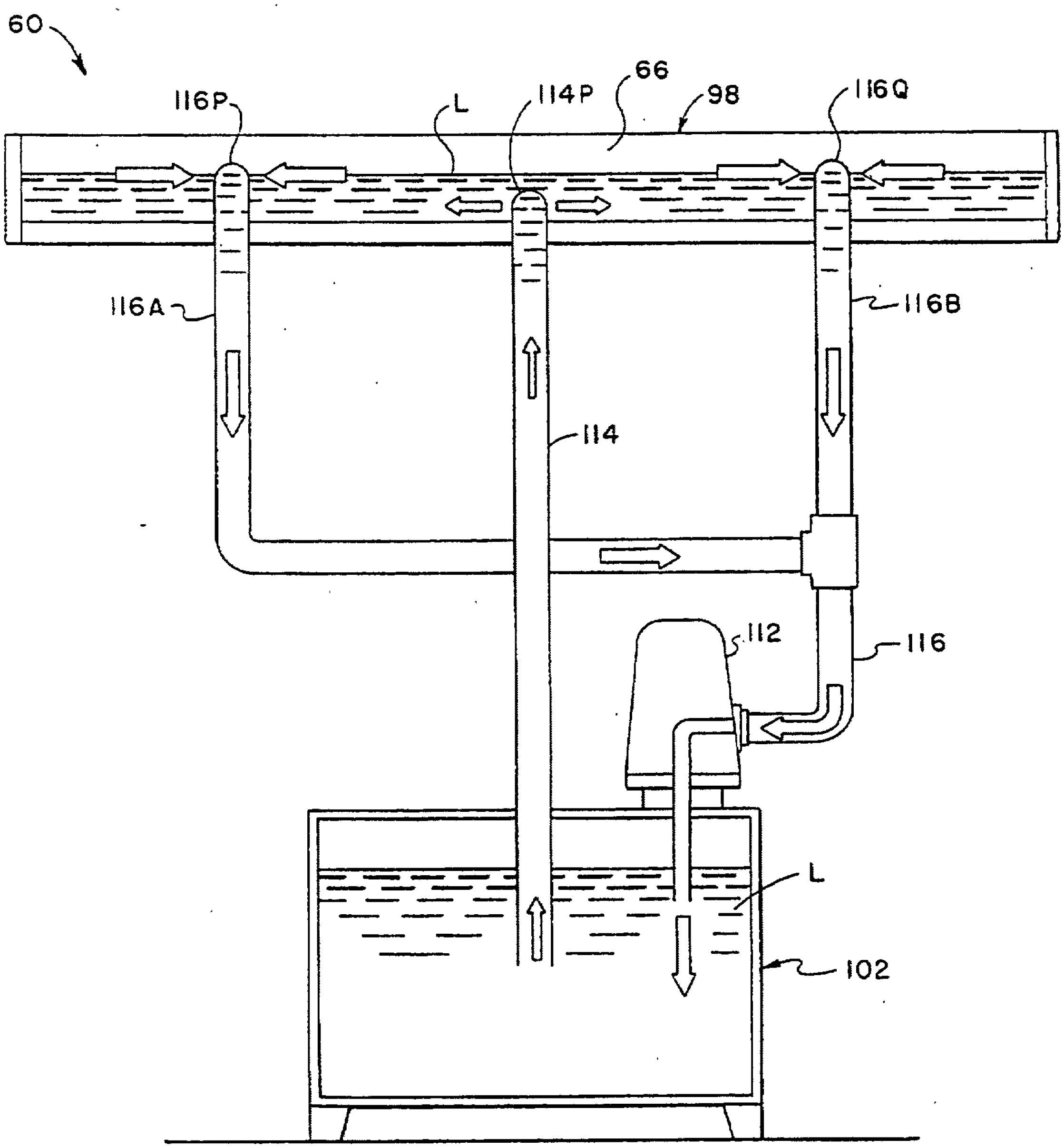


FIG. 6

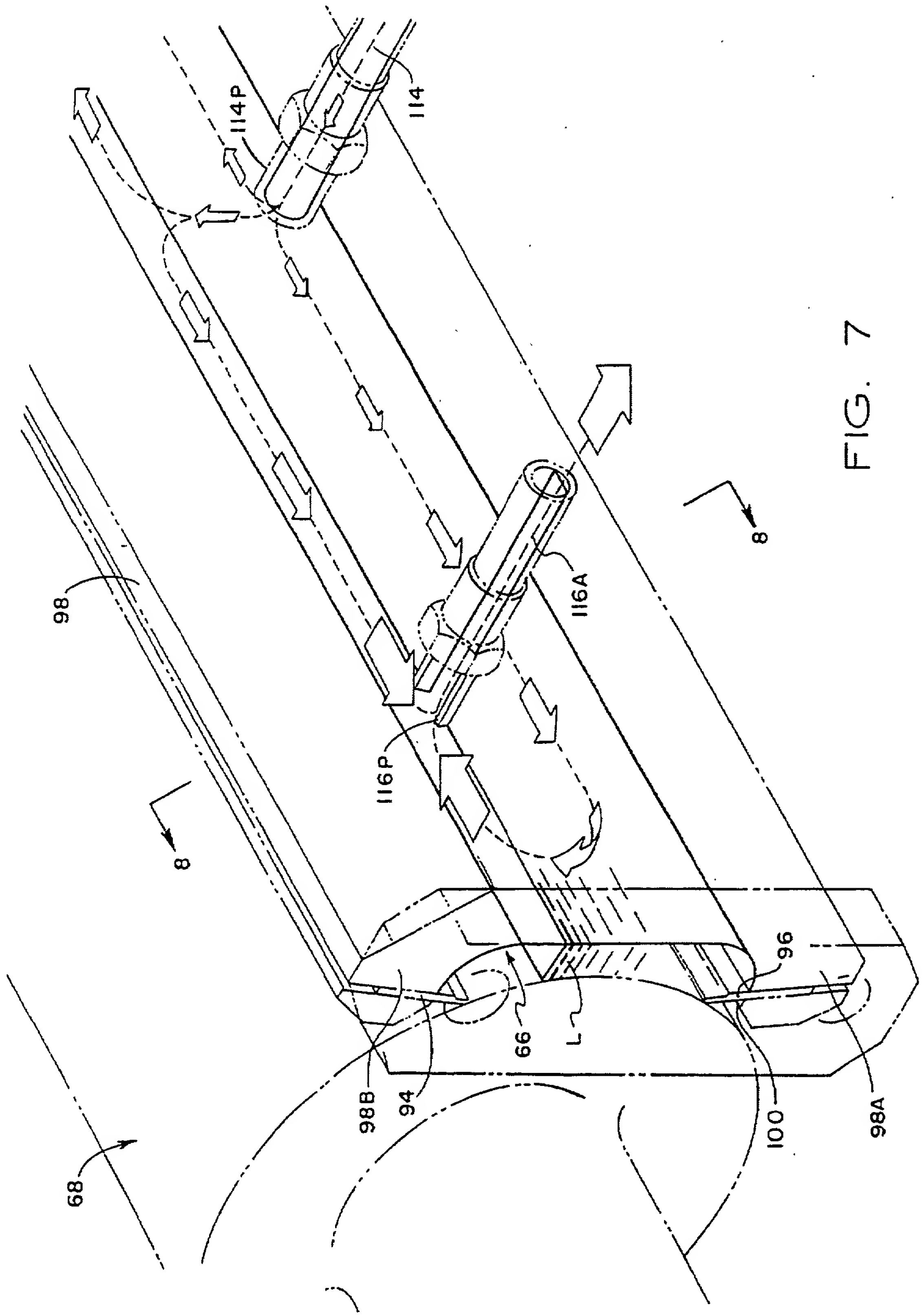


FIG. 7

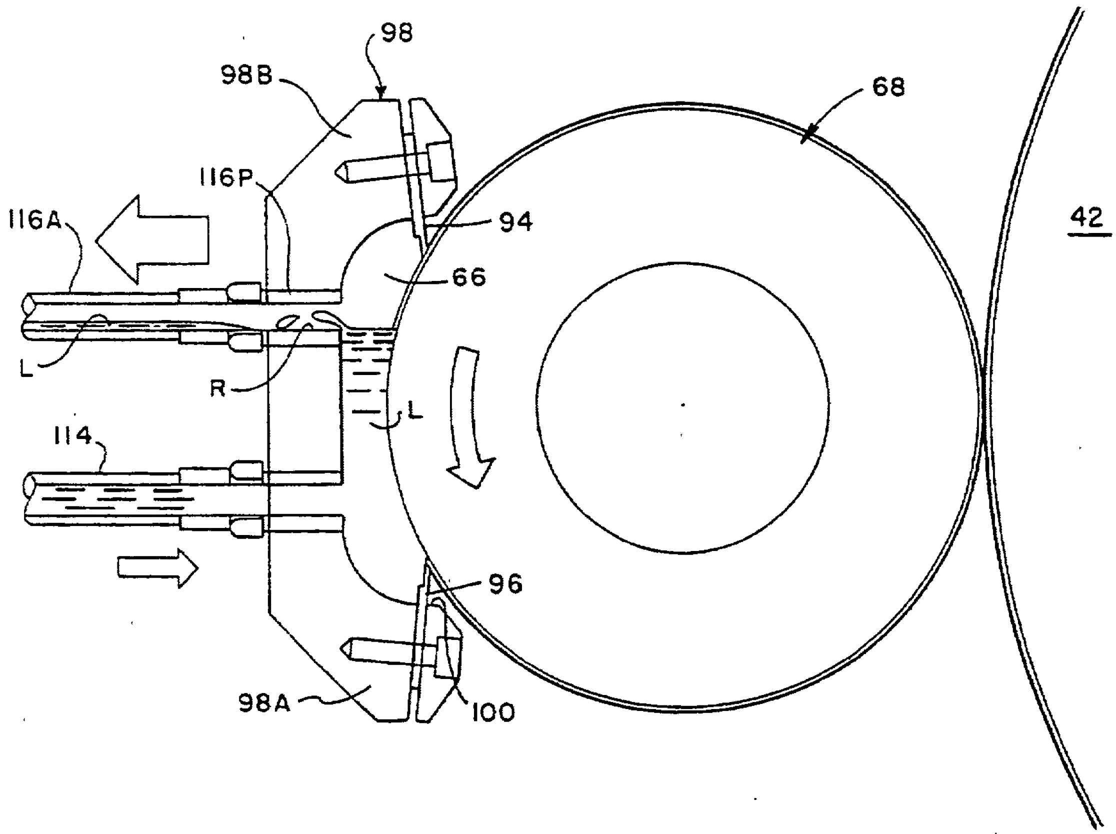
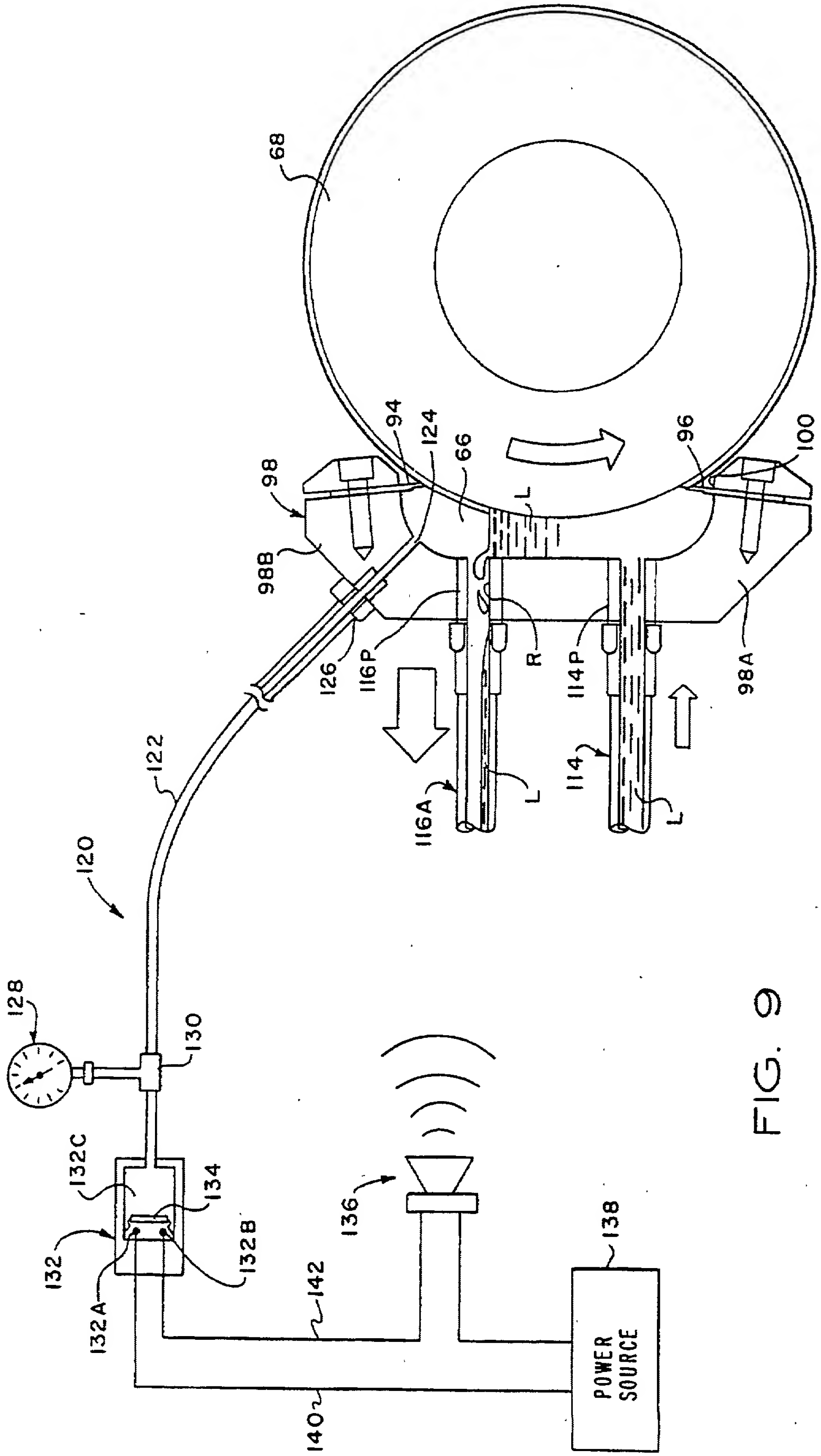


FIG. 8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POWER SOURCE

FIG. 9

COATING APPARATUS FOR SHEET-FED, OFFSET ROTARY PRINTING PRESSES

CROSS REFERENCE TO RELATED APPLICATION

This is a continuation of application Ser. No. 07/879,841, filed May 6, 1992 now U.S. Pat. No. 5,207,159 which is a continuation-in-part of application Ser. No. 07/752,778 filed Aug. 30, 1991 now U.S. Pat. No. 5,176,077.

FIELD OF THE INVENTION

This invention relates to sheet-fed or web-fed, offset rotary or flexographic printing presses, and more particularly, to a new and improved apparatus for the in-line application of protective and decorative coatings or inks to the printed surface of freshly printed sheets or web.

BACKGROUND OF THE INVENTION

Conventional sheet-fed, offset rotary printing presses typically include one or more printing stations through which individual sheets are fed and printed with wet ink. After final printing, the sheets are fed by a delivery conveyor system to the delivery end of the press where the freshly printed sheets are collected and stacked. In a typical sheet-fed, offset rotary printing press such as the Heidelberg Speedmaster line of presses, the delivery conveyor system includes a pair of endless gripper chains carrying spaced laterally disposed gripper bars and grippers which are used to grip and pull freshly printed sheets from the impression cylinder and convey the sheets toward the sheet delivery stacker. The gripper chains are driven in precisely timed relation to the impression cylinder by gripper chain sprocket wheels which are laterally spaced between a delivery drive shaft mounted on opposite sides of the press frame. The delivery drive shaft is mechanically coupled by gears for synchronous rotation with the impression cylinder.

Since the inks used with offset type printing presses typically remain wet and tacky for some time after printing, special precautions must be taken to insure that the wet inked surface of the freshly printed sheets is not marked or smeared as the sheets are transferred from one printing station to another, and through the delivery system to the sheet delivery stacker. The printed surface of the paper dries relatively slowly and can be smeared during subsequent processing, particularly when the printed sheets are stacked. In order to minimize smearing, a dryer may be mounted along the delivery path of the printed sheets, or an anti-offset spray powder may be sprayed on the printed surface.

In some printing applications, it is desirable that the press be capable of applying a protective and/or decorative coating over all or a portion of the surface of the printed sheets. Typical coating solutions include varnish, lacquer, dye, moisturizers and ink. Such coatings typically are formed of a UV-curable or water-soluble resin applied as a liquid solution or emulsion by an applicator roller over the freshly printed sheets to protect the ink and improve the appearance of the sheets. Use of such coatings is particularly desirable when decorative or protective finishes are required such as in the production of posters, record jackets, brochures, magazines, folding cartons and the like. In cases where a liquid coating is to be applied, the coating operation is carried out after the final ink printing has been performed, most desirably by an in-line coating application.

DESCRIPTION OF THE PRIOR ART

Various suggestions have been made for applying the coating as an in-line press operation by using the final printing station of the press as the coating application station. For example, in U.S. Pat. Nos. 4,270,483, 4,685,414 and 4,779,557, there are disclosed coating apparatus which can be moved into position to allow the blanket cylinder of the last printing station of a press to be used to apply a coating material to the sheets. In U.S. Pat. No. 4,796,556, there is disclosed a coating apparatus which can be selectively moved between the blanket cylinder or the plate cylinder of the last printing station of the press so that the station can be used as a coating station for the press.

Suggestions for overcoming the problem of the loss of a printing station when coating is desired have also been made, such as that set forth in U.S. Pat. No. 4,934,305 which discloses a coating apparatus having a separate timed applicator roller positioned to apply the coating material to the printed sheet while the sheet is on the last impression cylinder of the press. This is said to allow the last printing station to be operated simultaneously as both an ink application station and a coating station so that no loss of press printing unit capability results. Another approach to providing a coating station without losing the printing capabilities of the last printing station is to provide a totally separate coating unit downstream of the last printing station so that the coating is applied to the sheets after final printing and before the sheets have reached the sheet delivery stacker. Such an approach is suggested in U.S. Pat. Nos. 4,399,767 and 4,706,601.

Conventional coating apparatus which is operable as an in-line press operation utilizes an engraved transfer roller, with the liquid coating being applied to the engraved roller by means of a doctor blade assembly. The doctor blade assembly includes an elongated housing having a reservoir chamber extending the length of the transfer roller for holding a volume of coating liquid in wetting contact with the circumferential surface of the transfer roller. A pair of circumferentially spaced doctor blades extend longitudinally along the reservoir housing on either side of the chamber. The doctor blades are angled tangentially toward the transfer roller surface, and seal the reservoir chamber against the roller surface and wipe the roller surface to deposit liquid in the cells of the engraved transfer surface.

The reservoir chamber is pressurized with coating liquid, which is pumped from a remote supply drum into the upper region of the pressure chamber. After the pressure chamber fills to a certain level, it is returned to the remote drum by gravity flow. Occasionally, the doctor blade reservoir chamber becomes completely filled with the coating liquid when the volume of coating liquid being delivered to the doctor blade reservoir chamber exceeds the gravity flow return rate. The positive pressure may cause the seals at the ends of the roller to leak, allowing the coating liquid to drip onto the floor or onto adjacent press parts. Occasionally, the coating liquid may be slung from the roller onto adjacent press equipment and operator areas. Moreover, the buildup of positive pressure within the doctor blade reservoir chamber accelerates the wear of the end seals.

It will be appreciated that the transfer roller may be operated at high speeds, for example, on the order of

1,000 linear feet per minute, and that the end seals of the doctor blade assembly will tend to wear quickly. The end seal wear is accelerated by the buildup of positive pressure within the doctor blade chamber. Low volume drip leakage can be collected in a drip pan or catch tray, but as the end seals wear, the coating liquid will be slung from the transfer roller, thereby causing a difficult cleanup problem. When this occurs, the press must be shut down, the doctor blade head must be removed, and the end seals replaced. The steps of rebuilding or replacing the end seals and realigning the doctor blade head causes an unacceptable amount of press downtime.

One approach for overcoming the problem of end seal wear is to provide stationary end seals which are mounted on the press frame, and which bear in sealing engagement against the ends of the transfer roller, so that the doctor blade head may form a seal with stationary seals rather than with the dynamic seals carried on the transfer roller. Another approach is to use rotary end seals which include an end plate which is resiliently engaged against the end surface of the transfer roller, with a seal member being secured between the end plate and the end portions of the roller by quick removal mounting lugs.

While the foregoing mechanical approaches to limiting end seal wear and thereby avoiding leakage have been moderately successful, and some arrangements have reduced downtime by quick change mounting features, the end seals nevertheless are still experiencing accelerated wear and early failure, thereby causing frequent replacements and unacceptable downtime for correction of end seal leakage.

OBJECTS OF THE INVENTION

Accordingly, there exists a need for a new and improved in-line coating apparatus for use in a sheet-fed or web-fed, offset rotary or flexographic printing press for applying a protective and/or decorative coating to the printed surface of freshly printed sheets which does not require any expensive or substantial press modification or result in any impairment of normal press operating capability.

Specifically, the principal object of the present invention is to provide a new and improved in-line coating and/or inking apparatus of the character described which achieves a reduction in end seal leakage.

SUMMARY OF THE INVENTION

The present invention provides a new and improved in-line doctor blade apparatus for applying a protective and/or decorative coating and/or inking to the surface of freshly printed sheets in a sheet-fed or web-fed, offset rotary or flexographic printing press which is highly reliable and effective in use, yet which does not require any expensive or substantial press modification or result in any impairment of normal press operating capability.

The reservoir of a doctor blade head is supplied with coating material from a remote supply drum. To insure that an adequate supply of coating liquid is always present within the doctor blade reservoir, the coating material is drawn from the remote supply drum and is circulated by suction flow constantly through the reservoir. In contrast to the conventional approach of positively pressurizing the doctor blade reservoir with liquid coating pumped from the remote drum to the reservoir, the coating material is instead circulated through the reservoir by suction flow. That is, instead of charging the reservoir with coating liquid pumped from the remote drum and thereby creating a positive pressure condition within the doctor blade reservoir, circulation through the reservoir is induced by suction flow provided by a suction pump having an input connected for drawing coating liquid from the doctor blade reservoir, and returning it by forced (positive pressure) flow to the remote supply drum, rather than by gravity flow return.

As a result of the suction flow arrangement, the liquid material is drawn from the remote supply drum at a greater rate than the rate of withdrawal of the liquid material by the pickup roller, and a substantially constant supply of liquid material will always be present within the doctor blade reservoir. A benefit of the suction flow arrangement is that a positive pressure buildup does not occur within the doctor blade chamber. Moreover, liquid material which rises above a predetermined fill level is drawn out of the doctor blade reservoir by the suction pump, and is returned to the remote drum. Consequently, the end seals are not subjected to high pressure differential conditions. Instead, the suction flow arrangement produces a negative pressure differential, with the doctor blade chamber being operated at a level below atmospheric. Under negative pressure conditions, leakage of coating liquid is virtually nonexistent, and the operating life of the end seals is substantially increased.

According to another aspect of the present invention, visual and audible alerts are provided by a vacuum sensor line which is coupled to the vacuum space within the doctor blade chamber. The sensor line is coupled to a vacuum gauge which provides a visual indication of the suction pressure within the doctor blade chamber. A vacuum sensor switch is also coupled to the chamber for selectively applying electrical power to an audio transducer when the pressure within the vacuum chamber rises above a predetermined safe operating suction level.

Other features and advantages of the present invention will become more apparent from the following detailed description taken in conjunction with the accompanying drawings which disclose, by way of example, the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic side elevational view of a sheet-fed, offset rotary printing press having a coating apparatus embodying the present invention;

FIG. 2 is an enlarged fragmentary side elevational view taken substantially within the circular area designated "2" in FIG. 1 and showing the coating apparatus of the present invention during coating operation;

FIG. 3 is an enlarged fragmentary perspective view showing one side of the coating apparatus mounted in the press and illustrating the fluid path of coating material from a remote supply drum to the doctor blade reservoir of the coating unit;

FIG. 4 is an enlarged fragmentary sectional view taken substantially along the line 4—4 of FIG. 3;

FIG. 5 is a simplified flow diagram which illustrates a dual pump arrangement for circulating coating liquid from a remote supply drum to the doctor blade reservoir and return;

FIG. 6 is a simplified flow diagram which illustrates a single pump arrangement for circulating coating liquid by suction flow from a remote supply drum to the doctor blade reservoir and return;

FIG. 7 is an enlarged fragmentary perspective view of one end portion of the doctor blade coating apparatus of the present invention;

FIG. **8** is an enlarged sectional view taken substantially along the line 8—8 of FIG. 7; and,

FIG. **9** is a view similar to FIG. **8** which includes a suction pressure sensing circuit for providing a visual indication of suction pressure and an audible alert when the suction/vacuum pressure inside the doctor blade rises above a safe operating level, thereby signaling an impending end seal failure.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

As shown in the exemplary drawings, the present invention is embodied in a new and improved in-line doctor blade apparatus, herein generally designated **10**, for use in applying a protective and/or decorative coating or inks to the freshly printed surface of sheets printed in a sheet-fed or web-fed, offset rotary or flexographic printing press, herein generally designated **12**. In this instance, as shown in FIG. **1**, the doctor blade coating apparatus **10** is illustrated as installed in a four color printing press **12**, such as that manufactured by Heidelberger Druckmaschinen AG of the Federal Republic of Germany under its designation Heidelberg Speedmaster 102V (40"), and which includes a press frame **14** coupled at one end, herein the right end, with a sheet feeder **16** from which sheets, herein designated **18**, are individually and sequentially fed into the press, and at the opposite end, with a sheet delivery stacker **20** in which the finally printed sheets are collected and stacked. Interposed between the sheet feeder **16** and the sheet delivery stacker **20** are four substantially identical sheet printing stations **22, 24, 26** and **28** which can print different color inks onto the sheets as they are moved through the press **10**.

As illustrated, each of the printing stations **22, 24, 26** and **28** is substantially identical and of conventional design, herein including a sheet-fed cylinder **30**, a plate cylinder **32**, a blanker cylinder **34** and an impression cylinder **36**, with each of the first three printing stations **22, 24** and **26** having a transfer cylinder **38** disposed to withdraw the freshly printed sheets from the adjacent impression cylinder and transfer the freshly printed sheets to the next printing station via a transfer drum **40**. The final printing station **28** herein is shown as equipped with a delivery cylinder **42** which functions to support the printed sheet **18** as it is moved from the final impression cylinder **36** by a delivery conveyor system, generally designated **44**, to the sheet delivery stacker **20**.

The delivery conveyor system **44** as shown in FIG. **2** is of conventional design and includes a pair of endless delivery gripper chains **46**, only one of which is shown carrying at regular spaced locations along the chains, laterally disposed gripper bars **48** having gripper elements **50** used to grip the leading edge of a sheet **18** after it leaves the nip between the delivery cylinder **42** and impression cylinder **36** of the last printing station **28**. As the leading edge E of the sheet **18** is gripped by the grippers **50**, the delivery chains **46** pull the sheet away from the impression cylinder **36** and convey the freshly printed sheet to the sheet delivery stacker **20** where the grippers release the finally printed sheet.

The endless delivery chains **46** are driven in synchronous timed relation to the impression cylinder **36** by sprocket wheels **52** fixed adjacent the lateral ends of a delivery drive shaft **54** which has a mechanically geared coupling (not shown) to the press drive system. The delivery drive shaft **54** extends laterally between the sides of the press frame **14** adjacent the impression cylinder **36** of the last printing station **28**, and is disposed to be parallel with the axis of the impression cylinder. In this instance, the delivery cylinder **42**, which is constructed to allow adjustments in diameter by suitable means, is attached to the delivery drive shaft **54** so that the delivery cylinder is also rotated in precise timed relation with the impression cylinder.

In this respect, it is important to note that when the freshly printed sheets **18** are conveyed away from the impression cylinder **36** of the final printing station **28** by the gripper **50** carried by the delivery chains **46**, the wet inked surfaces of the sheets face the delivery drive shaft **54** and the sheets must be supported such that the ink is not smeared as the sheets are transferred. Typically, such support is provided by skeleton wheels or cylinders mounted to the press delivery drive shaft **54**, or as is now more commonly used, net equipped delivery cylinders marketed by Printing Research, Inc. of Dallas, Tex. under its registered trademark SUPERBLUE. That system, which is made and sold under license, is manufactured in accordance with and operates as described in U.S. Pat. No. 4,402,267, issued Sep. 6, 1983, to Howard W. DeMoore, the disclosure of which is incorporated herein by this reference.

More recently, vacuum transfer apparatus of the type disclosed in co-pending application Ser. No. 07/630,308, filed Dec. 18, 1990, entitled "Vacuum Transfer Apparatus for Sheet-Fed Printing Presses", which is also incorporated herein by reference, has been used. The vacuum transfer apparatus disclosed in that application can be used in place of delivery cylinders or skeleton wheels to pull the unprinted side of the sheet away from the delivery drive shaft **54** so that the wet ink surface of the sheets do not come into contact with any press apparatus.

In accordance with the present invention, the in-line doctor blade coating apparatus **10** for applying the protective or decorative coating or ink to the sheets **18** enables the press **12** to be operated in the normal manner without the loss of the final printing station **28**, and without requiring any substantial press modifications by employing the existing press delivery drive shaft **54** as the mounting location for the coating applicator roller. In presses having delivery systems such as skeleton wheels mounted on the delivery drive shaft **54** or a vacuum transfer apparatus as disclosed in the aforementioned co-pending application Ser. No. 07/630,308, conversion to a coating operation can be quickly and easily achieved by mounting on the press delivery drive shaft in place of the skeleton wheels or in addition to the vacuum transfer apparatus, a suitable support cylinder capable of performing the combined function of a coating applicator roller and a net enhanced delivery cylinder **42**. By utilizing the delivery cylinder **42** mounted on the delivery drive shaft **54** to also act as a coating applicator roller, protective coating will be applied to the printed sheet **18** in precise timed registration, and will permit the press to be operated with its full range of printing stations.

Toward these ends, the coating apparatus **10** of the present invention includes a relatively simple, positive acting and economical doctor blade coating unit, generally designated **60**, mounted to the press frame **14** downstream of the delivery drive shaft **54** and positioned to apply liquid coating material to the support surface of a

delivery cylinder **42** mounted on the delivery drive shaft. As can best be seen in FIGS. 2, 3 and 4, the doctor blade coating unit **60** herein comprises a pair of side frames **62**, only one of which is shown, it being understood that the other side frame is substantially the same as that of the side frame illustrated, attached to each side of the press frame **14**. Pivotally mounted to one end of each of the side frames **62** is a support bracket **64** carrying one end of a liquid material reservoir **66** and cooperating liquid material pickup roller **68** each disposed to extend laterally across the press **12** parallel with the delivery drive shaft **54**. The coating unit **60** is mounted between the upper and lower runs of the delivery chains **46** downstream of the delivery drive shaft **54**, and positioned so that the outer peripheral surface **70** of the pickup roller **68** can be engaged with the support surface of a delivery cylinder **42** mounted on the delivery drive shaft.

As best seen in FIGS. 2 and 3, the support bracket **64** is pivotally attached to the end of the side frame **62** by a shaft **72** disposed at the lower end portion of the bracket, and can be pivoted about the shaft by an extensible cylinder **74**, herein shown as a pneumatic cylinder, one end **76** of which is secured such as by welding to the side frame, and the opposite end **78** of which is coupled through a pivot shaft **79** to the upper end portion of the bracket. By extending or retracting the cylinder **74**, the extent of engagement of the pickup roller **68** against the surface of the applicator roller **42** can be controlled, and the pickup roller can be completely disengaged from the applicator roller **42**.

The coating pickup roller **68**, which is of conventional design and preferably one such as the Anilox rollers manufactured by A.R.C. International of Charlotte, N.C. and sold under the name "PRINTMASTER" having an engraved ceramic or chrome outer peripheral surface **70**, is designed to pick up a predetermined uniform thickness of liquid coating material or ink from the reservoir **66**, and then uniformly transfer the coating material to the support surface of the applicator roller **42**. To effect rotation of the pickup roller **68**, a suitable motor **80**, herein a hydraulic motor, is attached to one of the side frames **62** and coupled to a suitable hydraulic fluid source (not shown) through fittings **81A**, **81B**. Attached to the output of the motor **80** is an output gear which is drivingly coupled through a cluster gear **82** and a series of idler gears **83** each mounted on stub axles **84**, to a drive gear **86** attached to the end of a shaft **88** on which the pickup roller **68** is concentrically mounted. The shaft **88** of the pickup roller **68** is, in turn, journaled at each end to the brackets **64** through a releasable semicircular collar **90** attached by bolts **92** to the bracket. Herein, the axle of the terminal idler gear, designated **83'**, also serves as the shaft **72** for pivotally mounting the support bracket **64** to the side frame **62** so that when the bracket is rotated about the shaft, the terminal idler gear remains engaged with the drive gear **86** of the pickup roller **68**.

In this instance, as can best be seen in FIG. 4, the pickup roller **68** has a peripheral surface portion **68P** which projects radially into the reservoir **66** containing the supply of coating material or ink. A pair of upper and lower inclined doctor blades **94** and **96** attached to the doctor blade head **98** on shoulders **98A**, **98B** engage the roller surface to doctor the excess liquid coating material or ink picked up from the reservoir by the engraved surface **70** of the roller. The reservoir cavity **66** herein is formed within an elongated doctor blade head **98** having a generally C-shaped cross-section with an opening **100** extending longitudinally along one side facing the pickup roller **68**. The reservoir **66** is supplied with liquid material or ink from a supply drum **102** disposed in a remote location within or near the press **12**. Preferably, the doctor blade head **98** is removably attached to the brackets **64**, herein by bolts **104** having enlarged, knurled heads **106**, and which can be threaded through slots **108** formed in the brackets to clamp the reservoir in place on the brackets.

To insure that an adequate supply of liquid coating material is always present within the reservoir **66** and to prevent coagulation and clogging of the doctor blades **94** and **96** by the liquid coating material or ink, the coating material or ink is circulated through the reservoir by two pumps **110** and **112** as shown in FIG. 5. Pump **110** draws the liquid material L from the supply drum **102** via a supply line **114** and discharges it into a bottom region of the reservoir **66** through a delivery port **114P**, and the other pump **112** acts to provide suction to a pair of return lines **116A**, **116B** coupled adjacent a top region of the reservoir through return ports **116P**, **116Q** for withdrawing excess liquid coating material or ink from the reservoir. By supplying the coating material or ink from the supply drum **102** at a greater rate than the rate of withdrawal of material by the pickup roller **68**, a substantially constant supply of coating material or ink will always be present within the reservoir **66**. The excess coating material or ink which rises above the liquid level of the return port R (FIG. 8) is suctioned away by the suction return pump **112**.

The general arrangement of the pickup roller **68**, doctor blades **94** and **96**, and reservoir **66** is similar to that disclosed in U.S. Pat. No. 4,821,672 entitled "Doctor Blade Assembly With Rotary End Seals and Interchangeable Heads", the disclosure of which provides details concerning the end seal structure and operation of a pickup roller and reservoir usable with the present invention. According to an important feature of the present invention, however, the doctor blade reservoir **66** is not pressurized as taught by the prior art. Instead, coating liquid or ink is supplied to the doctor blade reservoir **66** by the suction flow produced by the pump **112**. In this arrangement, the suction pump **112** applies a vacuum or suction force in the reservoir which draws liquid material L from the supply through the supply conduit **114** to the reservoir and draws excess liquid material L from the doctor blade reservoir **66** through the return conduit **116** into the remote reservoir **102** at a rate which is greater than the rate that liquid coating material or ink is being supplied to the doctor blade reservoir through the supply conduit **114**. Because the suction return flow rate is greater than the supply flow rate, a positive pressure condition within the doctor blade reservoir is avoided, and a below atmospheric vacuum pressure level is provided.

Referring to FIG. 5, FIG. 6, FIG. 7 and FIG. 8, the liquid material is delivered into the lower region of the doctor blade reservoir **66**, and is withdrawn from the doctor blade reservoir near an upper region of the chamber through the return conduits **116A**, **116B**. The liquid level elevation of the return port is preferably selected to provide for the accumulation of liquid coating material or ink in more than about half of the doctor blade chamber, thereby insuring that the engraved surface of the pickup roller **68** will be thoroughly wetted by the coating material or ink L as it turns through the doctor blade chamber **66**. The reservoir **66** is bounded

vertically by lower and upper doctor head shoulders 98A, 98B. Accordingly, the return ports 116P, 116Q of return lines 116A, 116B are located at a liquid level R intermediate the limits established by the lower and upper shoulders. Any excess liquid coating material or ink which rises above the liquid level R of the return ports will be suctioned away by the pump 112.

It will be appreciated that the supply pump 110 is optional, and that the suction circulation system can be operated effectively with only the single suction pump 112 as shown in FIG. 6. In the single pump configuration, it may be necessary to prime the supply conduit 114 to obtain satisfactory operation. The two pump arrangement as shown in FIG. 5 is preferred for those installations in which the supply drum 102 is located at a distance that is too far from the press to achieve adequate suction flow. The auxiliary supply pump 110 provides positive flow input to the doctor blade reservoir at a fixed flow rate. The return suction pump 112 has a faster suction flow rate than the supply flow rate. Consequently, a positive pressure buildup in the doctor blade reservoir cannot occur. By utilizing two pumps as shown in FIG. 5, the liquid level within the doctor blade chamber 66 can be closely controlled, without positive pressure buildup, thereby reducing leakage through the end seals.

Referring to FIG. 8, it will be appreciated that the doctor blade chamber 66 is maintained at a pressure level below atmospheric by the suction action of the return flow pump 112. The coating liquid L rises to the liquid level of the return port R and is drawn off immediately by the suction pump 112. Additionally, air within the doctor blade chamber 66 is also evacuated, thereby reducing the doctor blade chamber pressure to a level below atmospheric. This negative pressure differential condition opposes leakage of coating liquid L through the end seals. Since the doctor blade chamber 66 is not positively pressurized, the end seals are operated under favorable pressure differential conditions, thereby extending their useful lifetime. Moreover, the negative pressure differential doctor blade assembly will accommodate a pickup roller having a chipped corner, which would leak under positive pressure conditions, but does not leak because of the negative pressure reservoir condition established by suction flow.

It is useful for the press operator to have an advance warning of an impending end seal failure. With advance warning, the press operator can schedule repair and/or replacement of the doctor blades and the end seals at a convenient time, for example between press runs or before undertaking the next printing job. Apparatus for monitoring the suction/vacuum condition within the doctor blade chamber 66 is provided by a pneumatic sensor circuit 120 as shown in FIG. 9. The pneumatic sensor circuit 120 includes a pneumatic sensor line 122 which is coupled in fluid communication with the doctor blade chamber 66 through a vacuum sensor bore 124 formed through the upper doctor head shoulder 98B. The vacuum sensor line 122 is coupled to the sensor bore 124 by a threaded fitting 126.

Continuous monitoring of the vacuum/suction condition within the doctor blade chamber 66 is provided by a vacuum gauge 128 which can be of any conventional design, for example a Bourdon gauge which is calibrated for dry air and covers the range from about zero to about twenty torrs. The vacuum gauge 128 is coupled into the sensor line 122 by a tee coupling 130. According to this arrangement, the press operator receives a continuous visual indication of the vacuum/suction condition within the doctor blade chamber 66.

According to another feature of the invention, the vacuum/suction line 122 is coupled to a vacuum switch 132. The vacuum switch 132 has a conductive, movable diaphragm 134 which moves into and out of electrical contact with switch electrodes 132A, 132B. That is, the diaphragm 134 is pulled out of contacting engagement with the switch electrodes 132A, 132B when the vacuum/suction level in the doctor blade chamber 66 is below a predetermined level. When the pressure level within the doctor blade chamber 66 rises above that preset level, for example in response to leakage of air through the end seals or around a worn doctor blade 94, the vacuum force within the vacuum chamber 132C of the sensor switch also rises, thereby permitting the conductive switch element 134 to engage the switch electrodes 132A, 132B.

When switch closure occurs, electrical power is applied to an audio transducer 136 from a power source 138. Electrical current is conducted through the pneumatic switch 132 to the audio transducer 136 through power conductors 140, 142. According to this arrangement, the press operator will receive an audible alert as soon as the suction/vacuum pressure in the doctor blade chamber rises above a safe operating level, thereby signaling wear failure of the doctor blades and/or an impending failure of the end seals.

From the foregoing, it should be apparent that the coating apparatus 10 of the present invention provides a highly reliable, effective and economical in-line apparatus for applying coating material to the freshly printed sheets 18 in a sheet-fed, offset rotary printing press 12 which allows the final printing station to continue to be used as a print station, yet which does not require any substantial press modification or the addition of a separate timed applicator roller. While a particular form of the present invention has been illustrated and described, it should be apparent that variations and modifications therein can be made without departing from the spirit and scope of the invention.

What is claimed is:

1. Coating apparatus for applying liquid material from a supply drum to an applicator roller which is engagable in an operative position with a doctor blade head having an elongated reservoir for receiving liquid material from the supply drum, said doctor blade head being adapted to extend in parallel with the applicator roller in the operative position with a portion of the peripheral surface of the applicator roller extending into said reservoir for wetting contact with liquid material contained therein, characterized in that:

seal means are coupled to the doctor blade head for sealing engagement against the applicator roller in the operative position, whereby the doctor reservoir is sealed with respect to atmospheric pressure; and,

circulation means are coupled to the doctor reservoir for inducing the flow of liquid material from said supply drum into the doctor reservoir, for returning liquid material by suction flow from the doctor reservoir to the supply drum, and for maintaining the doctor reservoir at a pressure level below atmospheric pressure.

2. Coating apparatus as defined in claim 1, said circulation means being characterized by

a supply conduit connecting the supply drum in flow communication with the doctor reservoir;

a return conduit connecting the doctor reservoir in flow communication with the supply drum; and,

a first pump coupled in series flow relation with the return conduit for inducing suction flow of liquid material from the doctor reservoir through the return conduit into the supply drum.

3. Coating apparatus as defined in claim 2, characterized in that the return conduit is coupled in flow communication with the doctor reservoir at a first liquid level location and the supply conduit is coupled in flow communication with the doctor reservoir at a second liquid level location, the first liquid level location of the return conduit being higher in elevation than the second liquid level location of the supply conduit when the doctor blade head is in the operative position.

4. Coating apparatus as defined in claim 1, said circulation means being characterized by:

a second pump coupled in series flow relation with said supply conduit for pumping liquid material from the supply drum to the doctor reservoir.

5. Coating apparatus as defined in claim 4, characterized in that the suction return flow rate provided by said first pump is greater than the supply flow rate provided by said second pump.

6. Coating apparatus as defined in claim 1, wherein the doctor blade head having first and second shoulders forming lower and upper liquid level boundaries for said reservoir, respectively, characterized in that said circulation means includes a return conduit coupled in flow communication with said reservoir at a liquid level location disposed intermediate the liquid level boundaries established by said first and second shoulders.

7. Coating apparatus as defined in claim 1, characterized in that a pneumatic conduit is coupled to the doctor reservoir for sensing air vacuum pressure within the doctor reservoir, and a vacuum gauge is coupled to the pneumatic conduit for providing a visual indication of air vacuum pressure in the doctor reservoir.

8. Coating apparatus as defined in claim 1, characterized in that a pneumatic conduit is coupled to the doctor reservoir for sensing air vacuum pressure within the doctor reservoir, a vacuum responsive switch having switch electrodes is coupled to said pneumatic sensor conduit, and an audio transducer is electrically connected to the switch electrodes for making and breaking an electrical circuit from a power source to said audio transducer.

9. Coating apparatus as defined in claim 1, characterized in that means are coupled to the doctor reservoir for supplying and evacuating liquid material to and from the doctor reservoir at differential flow rates, respectively, whereby a lower chamber region of the doctor reservoir is maintained in a filled condition and an upper chamber region of the reservoir is maintained in an evacuated condition.

10. Coating apparatus for applying liquid material from a supply drum to an applicator roller which is engagable in an operative position with a doctor blade head having an elongated reservoir for receiving liquid material from the supply drum, said doctor blade head being adapted to extend in parallel with the applicator roller in the operative position with a portion of the peripheral surface of the applicator roller extending into said reservoir for wetting contact with liquid material contained therein, and including doctor blade means attached to the doctor blade head for engagement against the peripheral surface of the applicator roller in the operative position, characterized in that:

circulation means are coupled to the doctor reservoir for inducing the flow of liquid material from said supply drum into the doctor reservoir and for returning liquid material by suction flow from the doctor reservoir to the supply drum; and

means are provided for mounting the coating apparatus on the side frame of a printing press adjacent to a transfer delivery cylinder, a liquid material coating blanket is secured to the transfer delivery cylinder, and including means for extending the applicator roller into engagement with the coating blanket in the operative position and for retracting the applicator roller out of engagement with the coating blanket in an idle position.

* * * * *

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United States Patent [19]

DeMoore

[11] **4,402,267**

[45] **Sep. 6, 1983**

[54] **METHOD AND APPARATUS FOR HANDLING PRINTED SHEET MATERIAL**

[75] Inventor: **Howard W. DeMoore**, Dallas, Tex.

[73] Assignee: **Printing Research Corporation**, Dallas, Tex.

[21] Appl. No.: **242,715**

[22] Filed: **Mar. 11, 1981**

[51] **Int. Cl.³** **B41F 21/00**

[52] **U.S. Cl.** **101/419**; 101/422; 101/426; 118/DIG. 15

[58] **Field of Search** .... 101/42.2, 416 R, 417, 101/418, 419, 426; 29/120, 130, 131, 121.3; 118/DIG. 15

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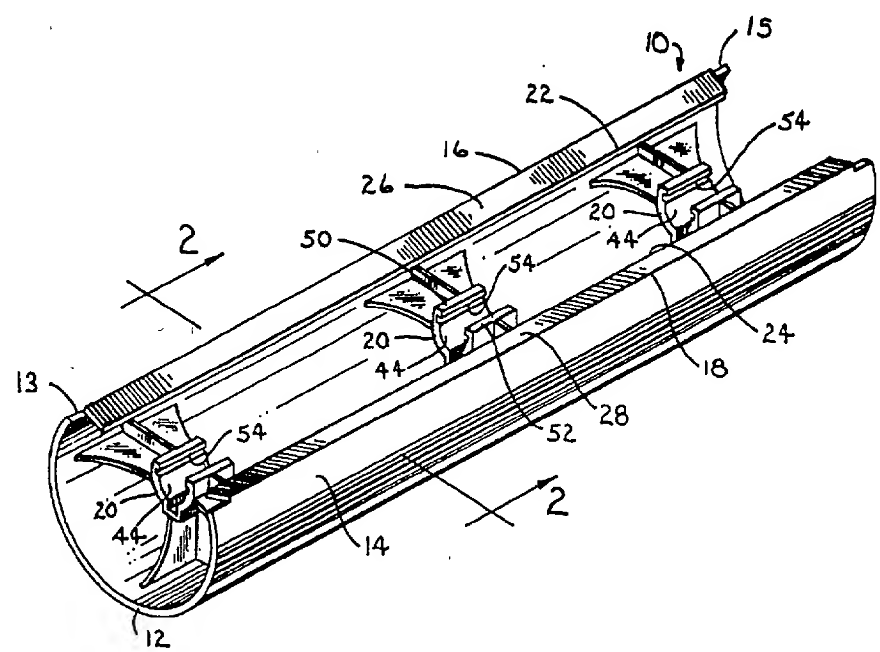
Primary Examiner—Edgar S. Burr
Assistant Examiner—Moshe I. Cohen
Attorney, Agent, or Firm—Fulwider, Patton, Rieber, Lee & Utecht

[57] **ABSTRACT**

A skeleton wheel or cylinder for supporting freshly printed sheet material between printing stations or at the delivery station of a printing press is provided with a loosely retained ink repellent fabric covering for supporting and conveying the sheet material without transfer of wet ink from one sheet to a successive sheet and without smearing the ink or indenting the surface of the sheet material. The circumferential surface of the skeleton cylinder is provided with a coating of a fluorocarbon plastic having a fabric base portion bonded to the surface of the cylinder structure. The low friction properties of the coating permit ease of shuffling movement of the fabric covering and the coating structure provides a cushioning effect to prevent smearing or indenting the sheet material by the fabric cover. The improved cylinder is provided with a plurality of retaining plates slidably fitted in axially spaced hub portions of the cylinder which plates are each locked in place by a set screw. The rim portion of the cylinder includes opposed parallel flanges on which the opposite ends of the fabric covering may be removably retained.

25 Claims, 4 Drawing Figures



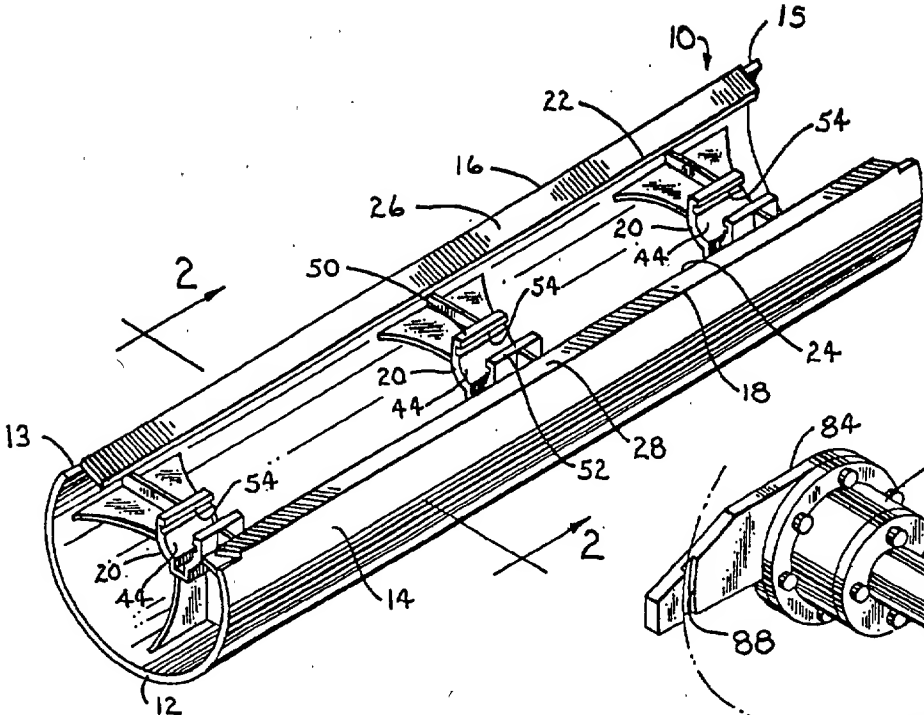


FIG. 1

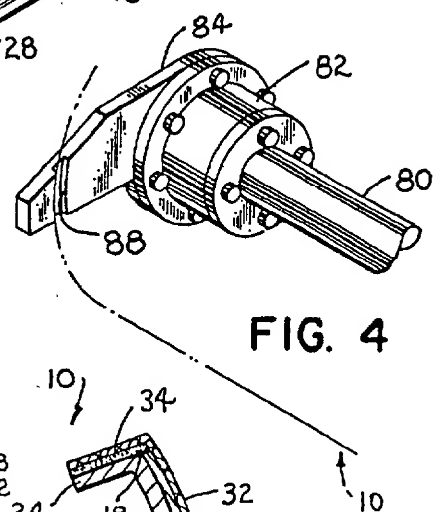


FIG. 4

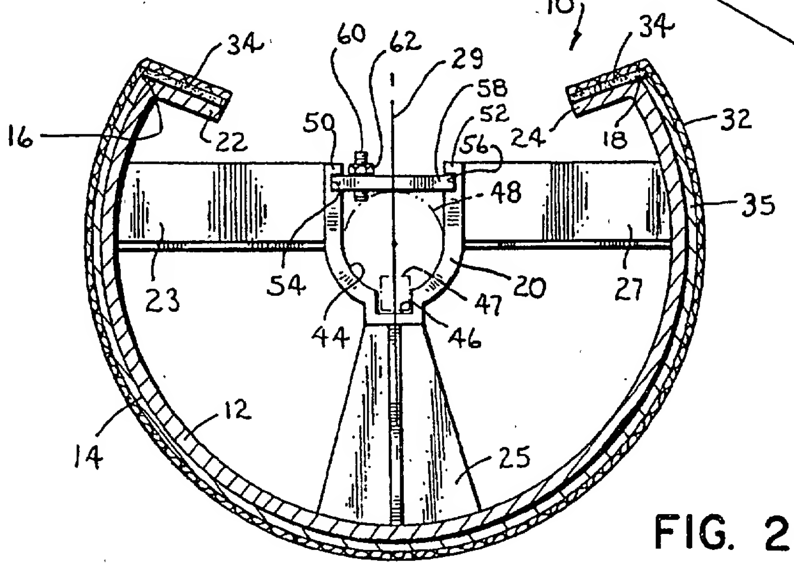


FIG. 2

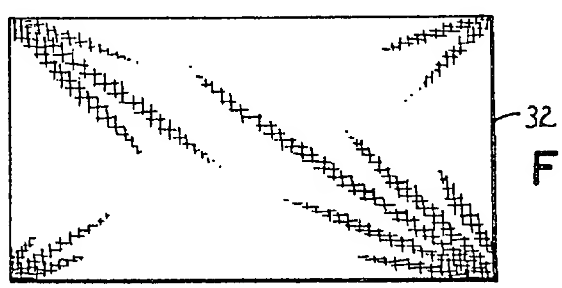


FIG. 3

METHOD AND APPARATUS FOR HANDLING PRINTED SHEET MATERIAL

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention pertains to a method and apparatus for providing improved support for freshly inked sheet material in a printing press or the like.

2. Background Art

It has been traditional in the art of printing press apparatus and the like to provide devices for supporting freshly inked sheet material when transferring the material from one printing station to another or when handling the sheets as they are delivered from the press wherein said devices comprise wheels of relatively narrow width and characterized by having circumferentially spaced teeth. Such devices are known by the term skeleton wheels in the printing press art. The problems inherent in handling freshly inked printed sheets and the like by skeleton wheels have been longstanding. In order to minimize the contact area between the skeleton wheels and the printed sheet traditional thinking led to the provision of wheels in the form of relatively thin disks having a toothed or serrated circumference. However, these types of wheels have not overcome the problems of smearing and marring the inked surface of the sheet material due to sliding action between the material and the projections or serrations. Moreover, the attempts to minimize the surface area in contact with the sheet material has also resulted in actual indenting or dimpling of the material itself.

Various efforts have been made to overcome the disadvantages of thin disk skeleton wheels. One of the more successful approaches has been completely contrary to the concept of minimizing the surface area. This more recent development is disclosed and claimed in my U.S. Pat. No. 3,791,644 wherein I provide for a substantially cylindrical drum or roller coated with an improved ink repellent surface comprising a layer of polytetrafluoroethylene. Although this improved skeleton wheel has been commercially successful, with continuous use such as is common in many commercial printing operations, there is over a period of time a slight accumulation of ink on the surface of the wheel.

In high speed commercial printing equipment, for example, it has been determined that in order to provide satisfactory printing quality the surface of the coated wheel must be washed relatively frequently with a solvent to remove any ink accumulation. Moreover, it has also been determined that the TFE coated wheels do not provide a cushioning effect which is important for the tightly stretched sheet material as it engages and is supported by the skeleton wheel.

In accordance with the present invention the problems with the prior art thin disk and other type skeleton wheel concepts have been overcome with a skeleton wheel of relatively great width and with an improved ink repellent and supportive structure which may be used in conjunction with the teaching of U.S. Pat. No. 3,791,644 as well as further improvements which I have made in support and handling apparatus for handling freshly inked sheet material.

SUMMARY OF THE INVENTION

The present invention provides an improved method for handling sheet material which has been freshly inked or printed on at least one side wherein the sheet

material is supported by a cylindrical roller or skeleton wheel which has mounted on a cylindrical surface thereof a relatively loose woven fabric or the like. In accordance with one aspect of the present invention there is provided a method for handling freshly printed sheet material in a printing press delivery apparatus or the like wherein a cylindrical roller or skeleton wheel has mounted on the support surface of the wheel a woven fabric of cotton or the like and which is relatively loosely supported on the support surface of the wheel. In accordance with another aspect of the present invention there is provided a method of supporting freshly printed sheet material or the like by means of a cylindrical skeleton wheel or roller having a support surface for a relatively lightweight fabric which is provided by a liquid repellent material of low friction characteristics such as one of the fluoroplastics or the like.

In accordance with another aspect of the present invention there is provided an improved skeleton wheel or roller for a printing press which includes a fabric covered supporting surface for engaging freshly printed sheet material or the like. In a preferred embodiment of the present invention the fabric covering for the skeleton wheel or roller comprises a lightweight cotton fabric or the like treated with a suitable liquid repellant. The fabric is relatively loosely supported on the surface of the cylinder or wheel to accommodate any slight relative movement between the sheet material and the skeleton wheel without marring the freshly inked surface or damaging the sheet material itself. The improved support roller or skeleton wheel of the present invention also contemplates a supporting surface for the fabric covering which may include a low friction fluoropolymer layer.

In accordance with another aspect of the improved skeleton wheel of the present invention the cylindrical support surface for the fabric covering may comprise a coated or impregnated fabric bonded to the cylindrical wheel surface and forming a supporting surface for the loosely secured fabric covering which is directly engageable with the sheet material.

The present invention provides a substantially improved yet simple and reliable handling apparatus and method in the form of a skeleton wheel for printing equipment and the like which is adapted to support sheet material including freshly inked surfaces thereof, without smearing or marking the printed surface and without damaging the sheet material itself. The improved fabric covered skeleton wheel of the present invention is easily installed on a printing press and the fabric covering is easily removed for cleaning or replacement as needed. Those skilled in the art will recognize these advantages as well as other superior features of the present invention upon reading the detailed description which follows in conjunction with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of the improved skeleton wheel of the present invention before application of the coating and fabric covering.

FIG. 2 is a detail section view taken along the line 2—2 of FIG. 1 showing the layers of materials covering the circumferential surface of the wheel;

FIG. 3 is a plan view of a piece of fabric covering adapted for mounting on the skeleton wheel of the present invention; and

FIG. 4 is a detailed perspective view of a portion of a press adapted to use the skeleton wheel of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The improved method and apparatus for handling sheet material in accordance with the present invention is used in a preferred form on high speed printing equipment of the type used, for example, in off-set printing. Such equipment may include one or more support rollers or wheels for handling the sheet material between printing stages and upon delivery of the printed material to a discharge magazine or stack. The particular location of the improved skeleton wheel or roller of the present invention in a typical printing press is believed to be readily understandable to those skilled in the art. Accordingly, a detailed description of the printing press is not believed to be necessary to a complete understanding of the present invention. In any case, reference may be made to my earlier U.S. Pat. No. 3,791,644 which discloses details regarding the location and function of a skeleton wheel for a typical multistation printing press. The present invention may, of course, be utilized with printing presses having any number of printing and delivery stations.

Referring to FIG. 1 of the drawings there is illustrated an elongated member or skeleton wheel generally designated by the numeral 10 comprising the improved skeleton wheel or roller in accordance with the present invention. The skeleton wheel 10 is characterized by a partial cylindrical rim portion 12 which is adapted to be mounted on a press adjacent apparatus, not shown, such as delivery grippers or the like. Accordingly, the outer cylindrical surface 14 of the rim portion 12 has an opening extending the axial width of the skeleton wheel defined by leading and trailing edges 16 and 18, respectively. The skeleton wheel 12 includes a plurality of spaced apart hub portions 20 which may be integrally formed with the rim 12 to comprise a one piece integral casting of aluminum, for example. The hub portions 20 are connected to the rim portion 12 by webs 23, 25 and 27 and are adapted to provide for supporting the skeleton wheel rigidly secured for rotation on a shaft on a printing press in a manner similar to the mounting arrangement disclosed in U.S. Pat. No. 3,791,644 or by an improved arrangement to be discussed herein. As shown in FIG. 1, the skeleton wheel 10 includes opposed elongated integral flange portions 22 and 24 which extend generally inwardly from the surface 14 of the rim 12. The flange portions 22 and 24 include elongated flat surfaces 26 and 28 provided for a purpose to be described further herein.

Referring now to FIG. 2 of the drawings there is illustrated in detail the improved surface construction of the skeleton wheel of the present invention including the fabric covering providing supporting contact with the printed side of a piece of sheet material while conveying the sheet toward a printing station or toward the press delivery magazine. Although the fluoroplastic covered skeleton wheel disclosed in my previous patent provided improvements in handling freshly inked sheet material I have discovered that, unexpectedly, the provision of a layer of fabric on the supporting surface of the skeleton wheel and rather loosely secured thereto further enhances the ability of the skeleton wheel to support and convey successive sheets of printed material with wet ink thereon without transfering the wet ink from a previous sheet to a successive sheet and without marring or depressing the surface of the paper. In accordance with the present invention it has been determined that a woven fabric, preferably cotton, of a relatively loose weave on the order of what is commonly known as gauze has produced the unexpected improvement in a method and apparatus for handling printed material that has wet ink on the surface thereof as it passes over and is supported by the skeleton cylinder. A suitable fabric in accordance with the present invention and illustrated in the embodiment of FIG. 3 comprises a loosely woven, lightweight cotton material such as gauze. A cloth having a forty count or forty mesh, such as the piece of fabric 32 illustrated in FIGS. 2 and 3, treated in accordance with the present invention and attached to the surfaces of the flanges 22 and 24 in a suitable manner has produced the unexpected improvement in the handling of printed sheet material in printing presses and the like. The piece of fabric 32 is preferably of rectangular shape dimensioned to completely cover the outer cylindrical surface of the rim 12.

A preferred method of preparing the fabric piece 32 in accordance with the present invention involves washing the fabric in water in the presence of a suitable fabric softener dissolved therein in rather liberal quantities. One suitable fabric softener which has been used in preparation of the fabric piece 32 is manufactured under the trademark "DOWNY" and, in the washing process, two to three times the normal recommended quantity of softener has been used for washing the fabric in plain water. After washing the fabric piece 32 and allowing same to dry a suitable fabric protector is applied to enhance the liquid repellancy characteristics of the material. A preferred type of fabric protector is manufactured under the trademark SCOTCHGARD by the 3M Manufacturing Company, Minneapolis, Minn. as their Part No. FC4101-C-12. Moreover, it has been determined that even though some ink will accumulate on the surface of the fabric threads over an extended period of operating time the provision of the fabric protector permits the occasional rubbing or agitation of the fabric by the press operator in place on the skeleton cylinder to break loose and remove dried ink particles or crystals which have accumulated on the fabric without requiring removal and washing of the fabric piece.

Referring to FIG. 2 a suitable method of attaching the fabric piece 32 to the outer surface of the rim 12 is by a double sided adhesive tape strip 32 disposed on and extending the length of each of the respective surfaces 26 and 28. Another suitable method of attaching the fabric piece 32 would be by the use of fastener strips such as of the type made under the trademark VELCRO. Those skilled in the art will appreciate that other means may be provided for attaching the fabric piece 32 to the flanges 22 and 24, however, the abovementioned methods provide for quickly attaching and removing the fabric piece 32 with respect to the wheel 10.

An important aspect of the present invention concerns the type of fabric support surface provided on the rim 12 and overlying the surface 14. The improved surface is preferably of a low coeffecient of friction such as may be provided by coating the metal surface 14 of the cylinder with a fluoroplastic as taught by U.S. Pat. No. 3,791,644. Although the combination of the coating described in the abovementioned patent together with the fabric member 32 attached thereover provides suitable performance it has been discovered that the fabric covering for the skeleton wheel 10 per-

forms somewhat better in eliminating any marring or depressions in the surface of the sheet material by the application of a coating including a fabric reinforcement as will be described herein.

Referring to FIG. 2 the rim portion 12 of the skeleton wheel 10 is provided with a coating 35 comprising a fluorocarbon composite coating material applied in one or more coats over a fabric base which is adhesively bonded to the cylindrical circumferential 14 of the rim portion 12. It is believed that the provision of the fabric base for the coating such as described herein provides a cushioning effect for the fabric piece 32 which is applied over the coating 35 and which reduces the tendency for the fabric piece 32 to indent or form depressions in the surface of the sheet material as well as substantially preventing the transfer of wet ink from one sheet to a successive sheet.

In a preferred method of preparing and forming the coating 35 a suitable piece of fabric such as cotton canvas of approximately 0.022 inch nominal thickness and having a waterproofing applied to one side thereof is cut somewhat oversize, approximately 4 to 5 inches all around, from the actual size required to cover the entire surface 14. The fabric is then suitably tacked to a substantially flat and smooth preparation surface to prevent movement or shrinkage while a first coat of the fluoropolymer or fluorocarbon material is applied thereto. A preferred composition for providing the coating 35 is a liquid fluoropolymer coating made under the trademark XYLAN by the Whitford Corporation, Westchester, Pa. A satisfactory coating material of the type referred to hereinabove is XYLAN 1010 composite type coating material which is self curing at room temperature.

After the aforedescribed fabric base is temporarily fastened to a suitable surface with the waterproof side facing said surface the non waterproofed side of the fabric is sanded lightly with a 220 grit paper to bring out the nap of the fabric. One coat of XYLAN 1010 coating material is then applied to the aforedescribed fabric and allowed to cure at room temperature. Once the first coating layer has been allowed to dry the coated fabric is removed from the temporary preparation surface and bonded to the surface 14 of the rim 12 using a suitable adhesive such as a contact cement made by 3M Corporation. The surface of the coated fabric piece which is applied to the surface of the rim portion 12 is the waterproofed side. The surface 14 is normally prepared for application of the adhesive in the prescribed manner to be clean and dry. Care should be taken to roll out the coated fabric piece of the coating 35 when it is applied to the surface 14 to prevent entrapment of air bubbles or the like.

After the adhesive is allowed to dry the fabric is trimmed to size and additional coatings of the fluoropolymer are applied and allowed to dry between coats. A suitable coating 35 is formed by the application of three additional layers of XYLAN 1010 coating material after the fabric base has been bonded to the surface of the rim 12. The surface formed by the coating 35 is preferably sanded lightly between each coat of fluoropolymer with, for example, 400 grit finishing paper.

The preparation of the surface coating 35 as aforedescribed provides a substantially glazed surface with a low coefficient of friction which is ink repellent and also provides for ease of movement of the fabric piece 32 when the same is attached to the cylinder 10. Although, in accordance with the present invention, the fluoropolymer coating described is particularly advantageous it is contemplated that other low friction plastic coatings may be applied to the aforementioned fabric base to produce a suitable surface for the fabric member 32. The particular fluorocarbon type coating of the general class of coatings referred to herein has produced the unexpected improvement of reducing ink transfer of one sheet to another in high speed printing equipment and has also, in combination with the fabric member 32, reduced depressing or indenting of the paper surface of the sheets. After the coating 35 has been prepared the fabric piece 32 is applied to the flanges 22 and 24 by the adhesive stripes 34 or other suitable fastening means loose enough so that with normal finger pressure the fabric may be locally moved over the surface of the coating 35 in all directions at least one eighth inch to one inch. Moreover, in printing presses in which the drive train has become loose with wear, for example, relative movement between the press impression cylinder and the skeleton wheel will not result in smearing of the ink thanks to the movability of the fabric covering with respect to the cylinder rim.

The improved skeleton wheel or cylinder of the present invention also includes improved means for attaching the wheel to the associated driving shaft of the printing press. Referring to FIGS. 1 and 2, the spaced apart hub portions 20 are provided with semi-cylindrical support surfaces 44 which are intersected by a suitable keyway 46 in which may be disposed a key 47 for drivingly engaging the skeleton wheel 12 with a press drive shaft indicated by the numeral 48 in FIG. 2. The hub portions 20 are provided with an improved retention means for mounting the skeleton wheel 10 on the shaft 48. The spaced apart hub portions 20 are each formed with integral axially extending bosses 50 and 52 spaced apart sufficiently to allow the skeleton wheel to be slipped radially on and off of the shaft 48. The bosses 50 and 52 are provided with opposed axially extending slots 54 and 56, respectively, which are aligned with each other to permit the insertion of a retaining plate 58. The retaining plate 58 is preferably of a length slightly less than the span between the bottoms of the grooves 54 and 56 so that the plate fits snugly in the respective grooves. The plate is preferably of a width equal to the axial length of the bosses 50 and 52. As shown in FIG. 2, the retaining plate 58 is provided with a socket head lock screw 60 threadedly engaged with the retaining plate and provided with a suitable lock nut 62. The lock screw 60 is offset from the center line which bisects the opening between the spaced apart bosses 50 and 52.

The lock screws 60 are adapted to be tightened to engage the periphery of the shaft 48 to prevent axial sliding of the skeleton wheel 10 with respect to the shaft and to permit minor radial adjustment of the skeleton wheel with respect to the shaft. When installing the cylinder 10 on the shaft 48 or removing the cylinder from the shaft the improved retaining plate 58 may be inserted in and removed from the respective grooves 54 and 56 followed by tightening or loosening of the screws 60, as the case may be, to provide a simplified arrangement for mounting and removing the cylinder with respect to the associated press drive shaft. The leading and trailing edges 16 and 18 are advantageously disposed substantially equidistant from the centerline 29 so that in some applications the skeleton wheel 10 can be turned end for end when the leading edge becomes worn or damaged.

Another feature of the present invention which has permitted improved retrofitting of a skeleton wheel such as the wheel **10** on certain types of press equipment is provided by the axially extending portions **13** and **15** of the rim **12** which extend in opposite directions respectively from the flanges **22** and **24**. In certain types of presses such as a model TP-38A made by the Miller Printing Equipment Companpy one or more stationary side plates are located adjacent ends of the skeleton wheel or cylinder and are positioned such that certain lengths of printed material will overlap the side plates and will be disfigured while being conveyed past the plates under the support of the skeleton wheel because the wheel cannot be moved axially on the shaft to the non printed area of the sheet. However, with the improved skeleton cylinder **10** having the axially extending rim portions **13** and **15**, a suitable annular groove may be cut in the side plates to accommodate the axial length of the wheel **10** to thereby substantially support the full length of the sheet material as it is conveyed by the wheel.

Referring to FIG. **4** there is shown a detail view of a portion of a skeleton wheel support shaft **80** similar to the shaft **48**. The shaft **80** is supported in a bearing assembly **82** which is bolted to a support assembly including a side plate member **84**. The plate **84** is stationary and prevents the use of a skeleton wheel or cylinder having a length substantially equal to the length of the sheet and providing adequate support thereof. However, by forming the annular groove **88** to have radial and axial dimensions with respect to the longitudinal centerline of the shaft **80** sufficient to clear the axial end portions **13** or **15** of the rim **12**, the cylinder **10** may be installed on a press equipped as shown to support substantially the entire length of the sheet material.

Those skilled in the art will appreciate that various modifications to the method and apparatus of the present invention may be made without departing from the scope of the invention as defined in the appended claims.

What I claim is:

1. A method for supporting and conveying sheet material which has been freshly printed and discharged from a printing press or the like without marring the freshly inked surface, comprising the steps of:

providing a skeleton wheel having a sheet supporting surface thereon;

providing a piece of fabric;

attaching said piece of fabric to said skeleton wheel to be disposed over at least that part of said surface which supports said sheet material, said piece of fabric being attached relatively loosely to permit and accomodate slight movement between the fabric and the skeleton wheel when the sheet material is supported and conveyed by skeleton wheel and

rotating said skeleton wheel to engage successive sheets of said sheet material in supportive and conveying relationship thereto by said piece of fabric without marring said freshly printed surface.

2. The method as set forth in claim **1** together with the steps of:

providing said piece of fabric of woven cloth.

3. The method set forth in claim **2** wherein:

said cloth is provided of woven substantially qauzelike cotton material on the order of about forty mesh.

4. The method set forth in claim **1** or **3** together with the steps of:

treating said fabric with a liquid repellent prior to attaching said piece of fabric to said skeleton wheel.

5. The method set forth in claim **4** together with the steps of treating said fabric with a fabric softening material prior to treating said fabric with liquid repellent.

6. The method set forth in claim **1** together with the steps of:

providing an ink repellent coating on said surface for supporting said piece of fabric.

7. The method set forth in claim **6** wherein:

said coating includes a polytetrafluoroethylene.

8. The method set forth in claim **6** together with the step of:

providing a fabric base portion for said coating.

9. In a skeleton wheel for supporting and transferring a freshly printed sheet from a printing station on a printing press or the like without marring the freshly inked surface;

a generally cylindrical rim segment having a generally cylindrical support surface formed thereon; and

a fabric covering disposed over at least a part of said support surface for supportively engaging one side of said sheet during the transfer thereof; and

means for securing said fabric covering to extend relatively loosely over said support surface to permit and accomodate slight movement between the fabric covering and said support surface when the printed sheet is supported and transferred by the skeleton wheel so that the freshly printed sheet is not marred.

10. The invention set forth in claim **9** wherein:

said fabric covering comprises woven substantially gauzelike cotton material on the order of about forty mesh.

11. The invention set forth in claim **10** wherein:

said fabric covering is treated with a liquid repellent.

12. The invention set forth in claim **10** wherein said fabric covering is treated with a fabric softening agent.

13. The invention set forth in claim **9** wherein:

said generally cylindrical support surface is delimited in a circumferential direction by opposed elongated flanges, and said skeleton wheel includes means for removably attaching said fabric covering to said wheel along said flanges.

14. The invention set forth in claim **13** wherein:

said means for attaching includes an adhesive strip mounted on said flanges.

15. The invention set forth in claim **13** wherein:

said rim segment extends axially beyond said flanges for supporting substantially the entire length of said sheet.

16. The invention set forth in claim **9** or **13** wherein:

said surface includes a low friction coating thereon.

17. The invention set forth in claim **16** wherein:

said coating comprises at least one layer comprising polytetrafluoroethylene.

18. The invention set forth in claim **16** wherein:

said coating includes a fabric layer on which at least one layer of a fluoropolymer coating is applied.

19. The invention set forth in claim **18** wherein:

said fabric layer is a woven canvas.

20. A method of supporting and conveying sheet material which has been freshly inked and discharged

from a printing press or the like without marring the freshly inked surface, comprising the steps of:

forming an ink repellent coating on a sheet supporting surface of a skeleton wheel;

treating a piece of fabric with a fabric softening agent;

treating the piece of fabric with a liquid repellent subsequent to treatment with said fabric softening agent;

attaching the piece of fabric to the skeleton wheel to cover the sheet supporting surface, said attaching step including mounting the piece of fabric relatively loosely over the sheet supporting surface such that the piece of fabric is capable of accommodating relative movement between the sheet material and the sheet supporting surface substantially without marring or damaging the freshly inked sheet material; and

rotating the skeleton wheel to engage successive sheets of the sheet material in supportive and conveying relation with the piece of fabric.

21. The method of claim 20 wherein said step of forming an ink repellent coating comprises the steps of applying an ink repellent agent to a fabric base portion and securing the fabric base portion to the skeleton wheel.

22. The method of claim 20 wherein the skeleton wheel sheet supporting surface has a generally cylindrical shape interrupted by an opening extending the axial width of the skeleton wheel, said opening being bounded by a pair of generally radially inwardly directed flanges, and wherein said attaching step comprises wrapping the piece of fabric about the sheet supporting surface and securing opposite ends of the piece of fabric respectively to the flanges.

23. A skeleton wheel for supporting and transferring a freshly inked printed sheet from a printing station of a printing press or the like without marring the freshly inked surface, comprising:

a wheel member having a generally cylindrical sheet supporting surface with an ink repellent coating formed thereon;

a fabric covering comprising a woven cloth treated with a fabric softening agent and then treated with a liquid repellent agent; and

means for attaching said fabric covering relatively loosely to said wheel member to cover said sheet supporting surface such that said fabric covering is capable of accommodating sufficient relative movement between a printed sheet supported and transferred thereby and said sheet supporting surface substantially without marring or damaging the printed sheet.

24. The skeleton wheel of claim 23 wherein said ink repellent coating comprises a fabric base portion with at least one layer of a fluoropolymer material applied thereon.

25. The skeleton wheel of claim 24 wherein said fabric base portion is formed from a canvas sheet.

* * * * *

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United States Patent [19]

Bird

[11] **Patent Number: 4,796,556**

[45] **Date of Patent: Jan. 10, 1989**

[54] **ADJUSTABLE COATING AND PRINTING APPARATUS**

[75] Inventor: **John W. Bird**, Westport, Conn.

[73] Assignee: **Birow, Inc.**, Westport, Conn.

[21] Appl. No.: **65,954**

[22] Filed: **Jun. 24, 1987**

[51] **Int. Cl.**⁴ **B05C 11/00**

[52] **U.S. Cl.** **118/46**; 118/262; 101/177

[58] **Field of Search** 118/46, 262, 249; 101/177

[56] **References Cited**

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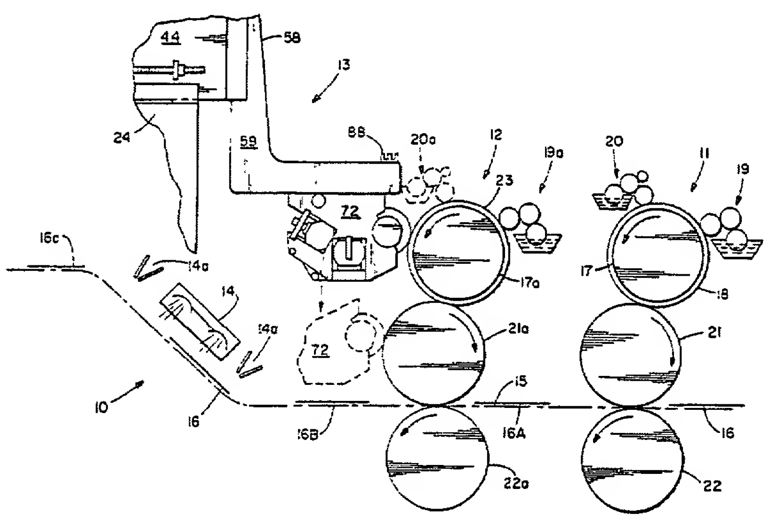
Primary Examiner—Shrive Beck
Assistant Examiner—Alain Bashore
Attorney, Agent, or Firm—Peaman & Green

[57] **ABSTRACT**

An offset lithographic printing machine having a plurality of in-line liquid application stations, at least one of which is an ink image printing station for printing lithographic ink images onto suitable receptive copy sheets, and the final downstream liquid-application station being a coating application station for printing a protective, and/or aesthetic coating over selected portions of, or over the entire ink image-printed surface of the copy sheets. The coating application station comprises a plate cylinder adapted to print liquid coating composition onto predetermined selected areas of the ink image-printed copy sheets by offset-transfer to an intermediate blanket cylinder, a said blanket cylinder adapted to receive said liquid coating composition from the plate cylinder for retransfer onto predetermined selected image-printed areas of the image-printed copy sheets, and also adapted to receive a continuous liquid coating composition for retransfer as a continuous overall coating over the image printed areas of the image printed copy sheets. An adjustable coating-application carriage is supported for movement into coating association with either the plate cylinder blanket cylinder desired, for the application of a printed coating over either preselected limited areas or over the entire image-printed surface of the copy sheets.

23 Claims, 4 Drawing Sheets



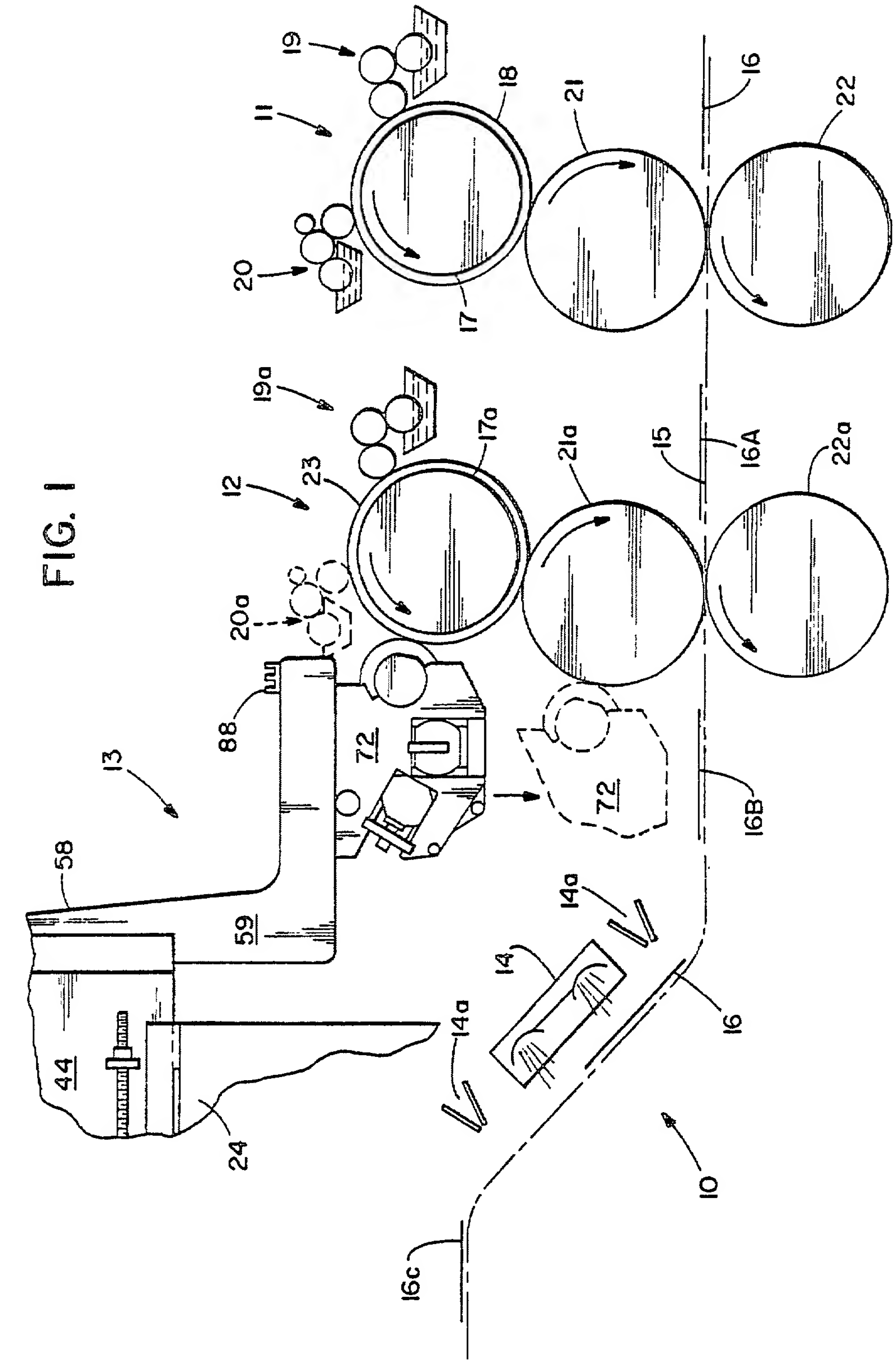

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FIG. I

FIG. 2A

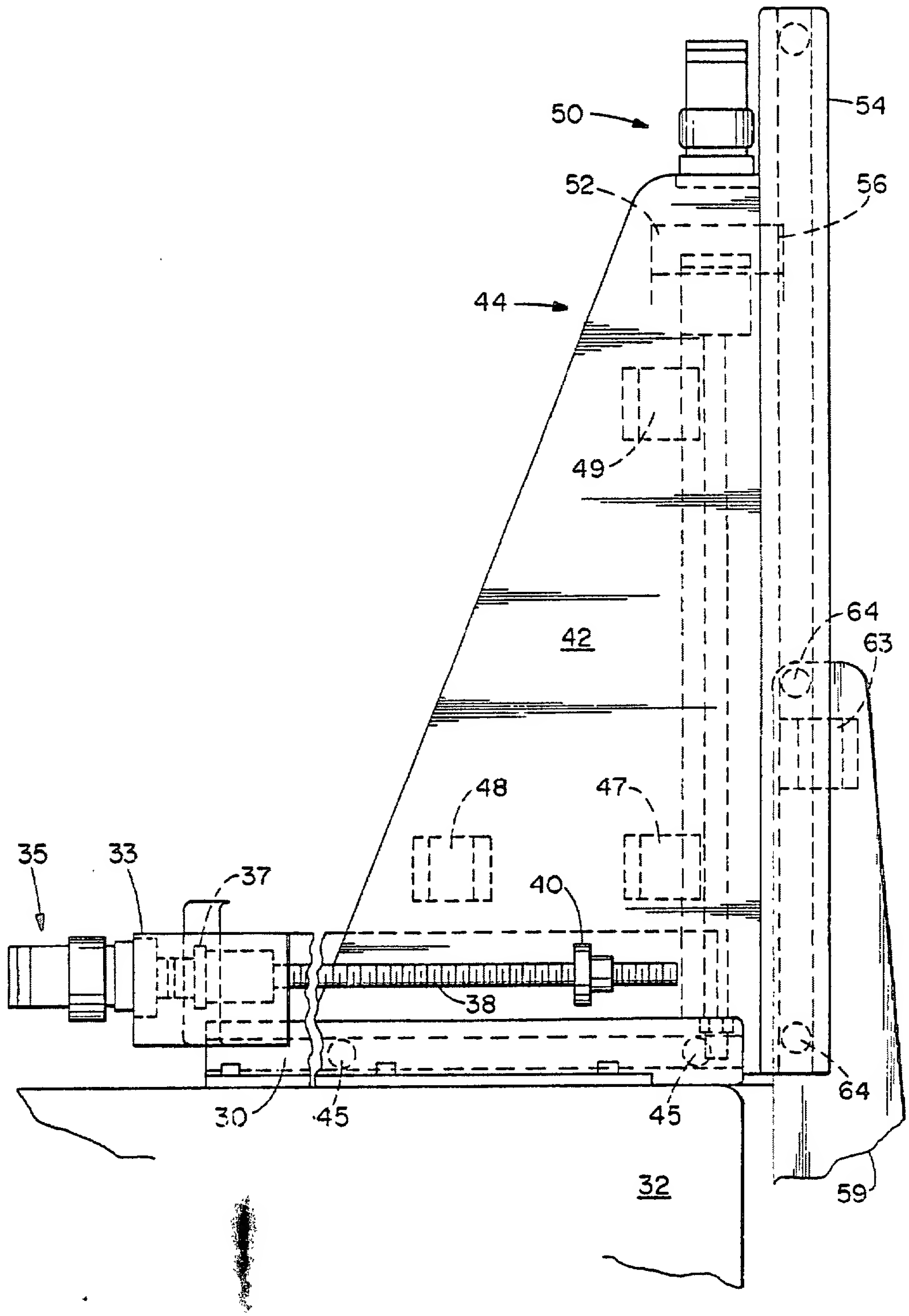

FIG. 2B

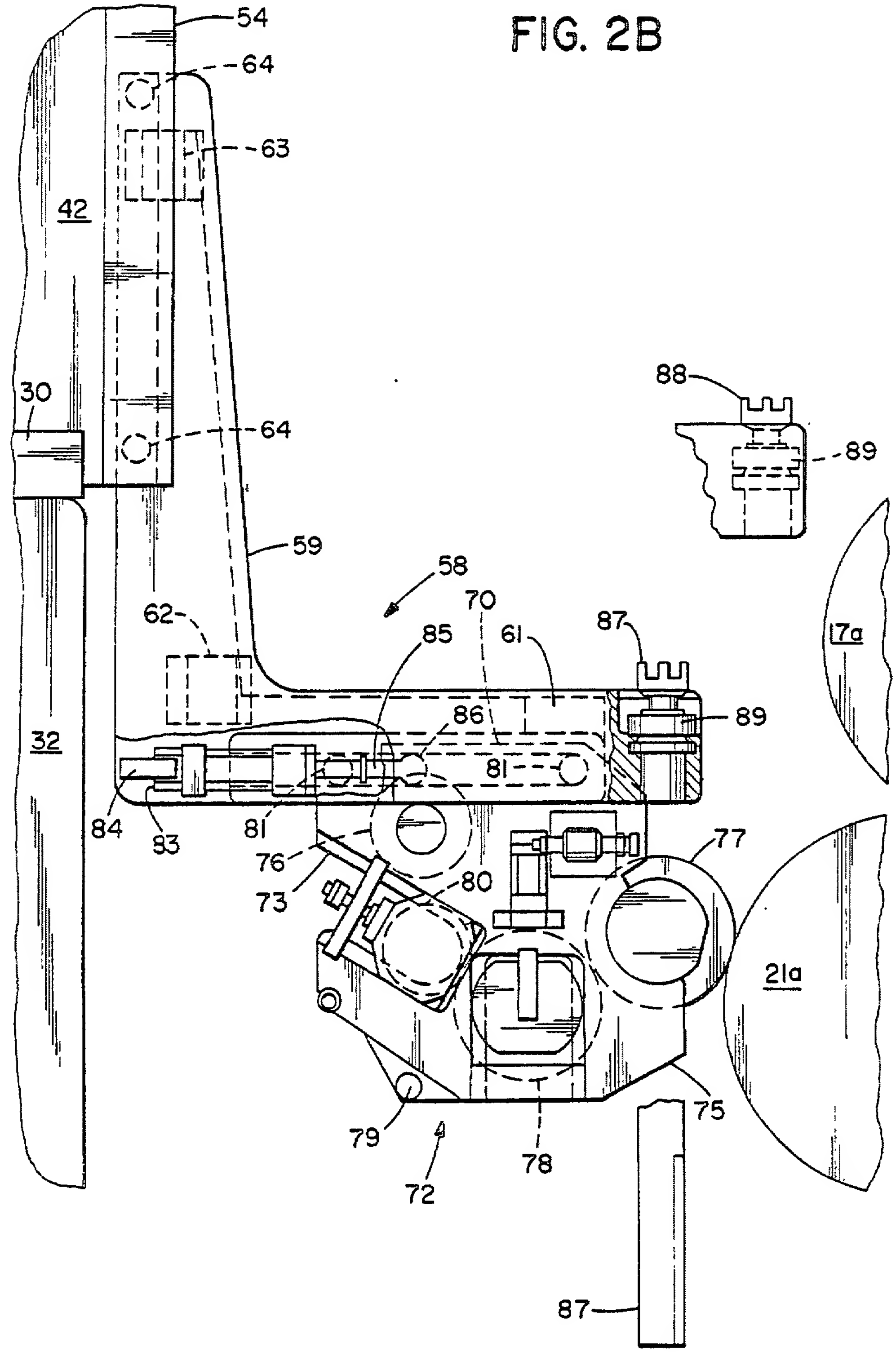
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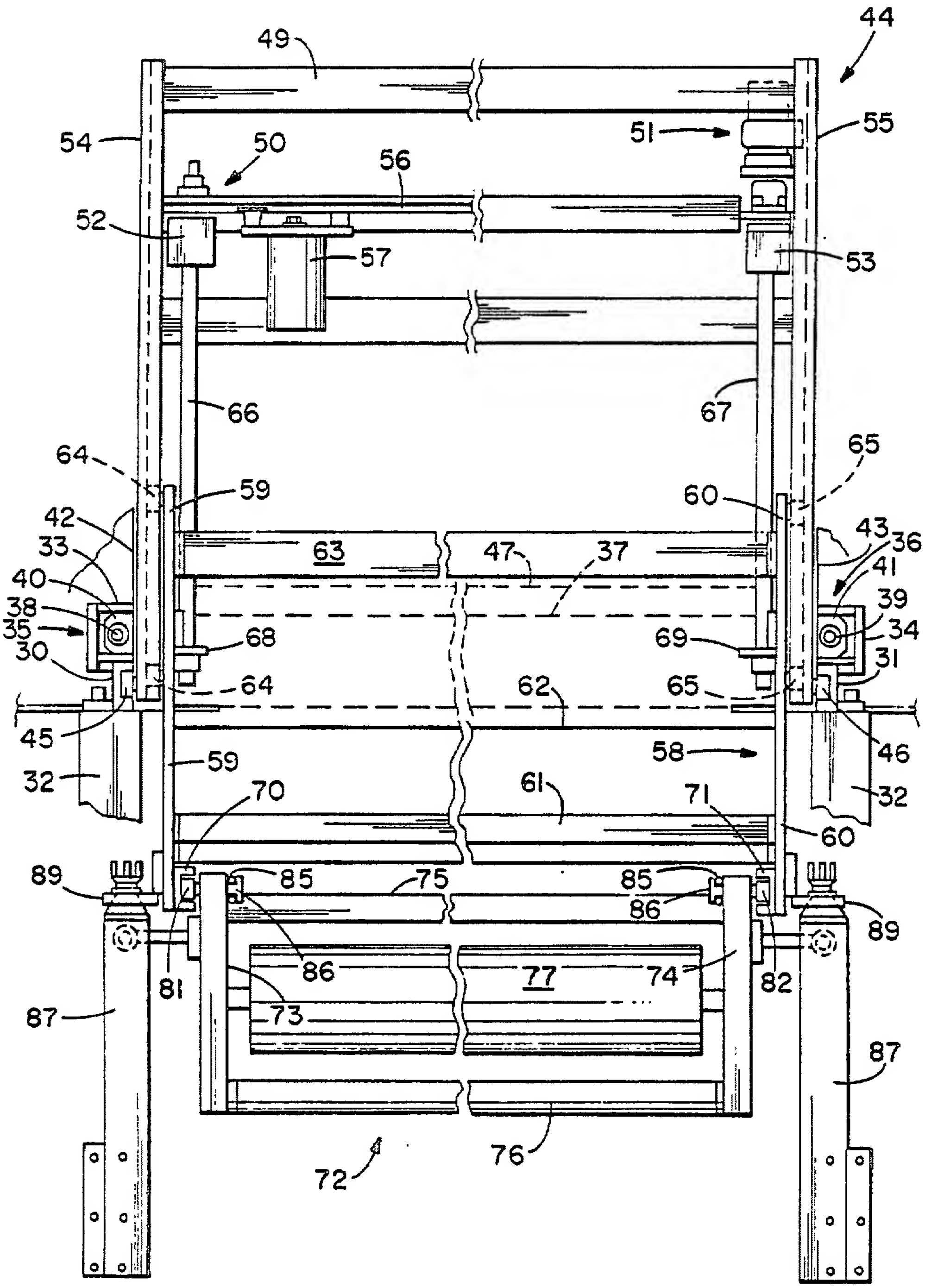
FIG. 3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ADJUSTABLE COATING AND PRINTING APPARATUS

BACKGROUND OF THE INVENTION

Conventional lithographic offset printing machines or presses comprise one or more image printing stations each having a printing roll (sometimes referred to as a plate cylinder) to which is fastened a thin hydrophilic, oleophobic printing plate having image areas which are oleophilic and hyrdoprobic and background areas which are oleophobic and hydrophilic. The plate surface is continuously wetted with aqueous' damping solution which adheres only to the background areas, and inked with oleoresinous ink which adheres only to the image areas of the plate as wet ink. The ink is offset transferred to the rubber surface of a contacting blanket roll (sometimes referred to as a blanket cylinder), and then retransferred to the receptive surface of a copy web or a succession of copy sheets, such as of paper, where the ink air-dries by oxidation and curing after passing through a drying station.

Since image-drying is gradual, it is conventional to spray the printed copies with starch or other "stilting" powder before the copies are stacked. This prevents sticking of the ink images to adjacent copies and also permits the circulation of air for the oxidation curing process.

In cases where cost is not a factor and/or where the aesthetic advantages of a protective supercoating are desired, it is known to provide the printing machine with a downstream coating station having a blanket roll associated with a coating application unit for the application of an overall protective coating over the entire printed area of the copy sheets or web. This also avoids the necessity of powdering the printed images. Reference is made to U.S. Pat. No. 4,270,483 for its disclosure of such an apparatus. The coating unit of U.S. Pat. No. 4,270,483 is pivotally-associated with the blanket roll for movement between coating and noncoating or retracted positions.

It is known to apply pattern coatings of protective composition by means of blanket rolls by cutting into the rubber surface of the blanket to leave raised or relief surface islands which selectively receive the coating composition from the application roll for retransfer to selected areas of the copy sheets in the form of pattern coatings. This procedure has several disadvantages. The make-ready time required for the preparation of such relief blanket rolls is excessive and the procedure requires the tedious, precision efforts of an expert in order to approximate the required registration, whereas precise relief printing plates used on a printing roll can be produced photographically in a short period of time with a minimum of effort and expertise. Moreover, the attachment of a relief printing plate to a plate cylinder provides some degree of adjustability, axially as well as circumferentially, to provide better registration if necessary, whereas no adjustment of the relief portions is possible relative to the blanket roll or cylinder.

Protective coating compositions also improve the appearance of printed documents, particularly high quality, multi-color copies such as posters, record jackets, product brochures, etc., by providing glossy or matte finishes over the entire image-printed surface or over selected image-printed portions thereof such as photographs, product illustrations, etc. Selected area coating, spot coating or perfect registration over predetermined limited printed areas of the copies is advantageous from a cost standpoint since the coating compositions are relatively expensive and the volume required is reduced if the coating is only printed in registration where desired. Also, spot coating is frequently used as a means for highlighting certain portions of the printed copies such as company name or logo, product illustrations, photographs, etc.

While the cost of the protective coating compositions is an important factor, a more important cost factor is the necessity of removing the printed copies from an offset printing press and then running them a second time through a coating machine to print either a full protective coating or a spot protective coating, as desired. This problem is overcome by U.S. Pat. No. 4,270,483 with respect to the in-line printing of overall or continuous protective coatings but the problem of providing in-line spot printing of protective coatings with a minimum of make-ready time and a high degree of precision thickness remains.

SUMMARY OF THE INVENTION

An essential objective of the present invention is to provide a printing machine or press for the printing of imaged subject matter onto a receptive substrate, such as a copy web or a succession of copy sheets, said printing machine having a downstream coating station designed for the application of either continuous or spot coatings, as desired, over the image-printed copies in a continuous in-line process.

Another object of the present invention is to provide a coating apparatus designed to be mounted at the final downstream ink-application station of a conventional offset printing machine or press having a plurality of ink-application stations to convert said machine or press, intermittently if desired, to the in-line application of either continuous or spot coatings, as desired.

Yet another object of this invention is the provision of a single coating application apparatus mounted in association with the final downstream liquid application station of a printing press having a plurality of liquid application stations, each having a plate cylinder, a blanket cylinder and an impression cylinder, the coating application apparatus comprising a coating carriage which is adjustable between one coating position in which it coats the plate cylinder and another coating position in which it coats the blanket cylinder of the final downstream station to convert said station to a coating station for the application of either spot or continuous coatings to the surface of the image-printed copies.

The novel apparatus of the present invention comprises a coating application apparatus for an offset printing machine and a printing machine containing such an apparatus, the coating application apparatus having a movable carriage designed for operative association in one position with the plate cylinder and in another position with the blanket cylinder of the final liquid application station of the offset printing machine, the coating carriage being adjustably supported for automatic movement between said two different coating positions. One coating position brings the coating application roll of the carriage into coating association with the plate cylinder for the offset formation of predetermined printed spot coatings onto predetermined image-printed areas of the copy sheets. The other coating position brings the coating application roll of the car-

riage into coating association with the blanket cylinder for the offset formation of a continuous coating onto the entire image-printed surface of the copy sheets. This enables the printing machine to image-print and coat-print the copy web or sheets in a continuous in-line operation, the apparatus being adjustable in simple fashion with a minimum make-ready time to adapt the coat-print step to the application of either spot coatings or continuous coatings depending upon the requirements of the printing operation. This increases the versatility of the offset printing machine, avoids the need for separate printing machines or for separate runs of the printed stock and enables the in-line precise printing of spot coatings in tight register and adjustable thickness, which was not possible with any prior-known offset printing machine.

The novel apparatus of the present invention enables the final downstream liquid application station of the printing machine to be used as either an ink-printing station or as a coating-application station and permits simple and rapid conversion between such utilities.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a vertical cross-sectional view through two downstream liquid application stations of an offset printing machine, illustrating a coating-application unit according to one embodiment of the present invention;

FIGS. 2A and 2B are segmented, detailed side views of coating application unit of FIG. 1 and

FIG. 3 is a horizontal front view of the coating application unit of FIG. 2.

DETAILED DESCRIPTION OF THE INVENTION

Referring to the drawings, FIG. 1 illustrates a downstream portion of an offset printing machine 10 comprising two liquid application stations 11 and 12, the latter including a coating apparatus 13 comprising a coating carriage 58, a radiation drying station 14 including air knives 14a, and a continuous copy sheet gripper system 15 which moves a succession of copy sheets 16 through the printing machine.

The first liquid application station 11 is a conventional offset image printing station comprising a plate cylinder 17, to which is clamped an imaged lithographic printing plate 18 carrying oleophilic image areas, such as words, photographs, etc. on an oleophilic background. The conventional clamping means permits some degree of lateral or axial adjustment and some degree of wrap-around or circumferential adjustment of the plate 18 relative to the plate cylinder 17. Plate cylinder 17 is associated with a dampening system 19 for wetting the entire background surface of plate 18 with aqueous dampening fluid, and with an inking system 20 for inking the imaged areas of the plate 18 with liquid oleoresinous ink.

The inked plate 18 is rotated against the ink receptive surface of a blanket cylinder 21, to which the wet ink images are offset or transferred, and the blanket cylinder 21 is rotated against a copy sheet 16, passed in the nip between the blanket cylinder 21 and an impression cylinder 22, to transfer the wet ink images to the copy sheet 16 and form an image-printed copy sheet 16A which is conveyed to the last liquid application station 12 which includes the coatingapplication apparatus of the present apparatus.

The coating application station 12 can be similar to the inking station 11 with respect to the plate cylinder 17a supporting a printing plate dampening system 19a, blanket cylinder 21a and impression cylinder 22a since in a conventional offset printing machine having a plurality of liquid application stations, all of the stations are generally similar but use different printing plates to image different areas of the same copy sheet with different colored inks. The present apparatus modifies the final downstream inking station to convert it permanently or intermittently to a versatile coating station.

Plate 23 is an offset relief printing plate, preselected areas of which are raised above the background, generally referred to as "relief spots". Such spots are sized and positioned to correspond to areas of the image-printed copy sheets 16a which it is desired to selectively coat.

The essential novelty of the apparatus of FIG. 1 resides in the adjustable coating apparatus 13 which is mounted onto the frame 24 of the printing machine for extension of the coating carriage 58 into the liquid application station 12 for adjustable coating association with either the coating plate cylinder 17a or the coating blanket cylinder 21a, as desired.

The coating application apparatus 13, shown in greater detail in FIGS. 2 and 3, comprises a preferred embodiment of the present invention in that it includes a coating carriage 58 which is horizontally adjustably, in the machine direction, for movement between retracted or passive position and extended or active position, and also vertically adjustable for movement between the levels of the plate cylinder and the blanket cylinder. Moreover, the coating carriage 58 comprises a horizontally adjustable coating applicator unit 72 which is movable in the machine direction between different extended coating positions to accommodate plate and blanket cylinders which are not in vertical alignment, as shown by FIGS. 1 and 2B.

The coating application apparatus 13 of FIGS. 2A and 3 comprises a spaced pair of parallel, horizontal support rails 30 and 31 or legs designed to be bolted to frame portions 32 of the printing machine beyond station 12, rails 30 and 31 each being fastened to a gear housing 33, 34 of a hydraulic horizontal screw drive member 35, 36 connected to each other for simultaneous operation by a drive chain 37. The screw drive members 35 and 36 comprise reversible drive screws 38, 39 which threadably engage nuts 40, 41 which are fixed to the spaced vertical walls 42, 43 of the vertical lift housing 44.

Housing 44 is provided adjacent the bases of walls 42 and 43 with outward projecting cam follower or wheel pairs 45, 46 which are engaged within the horizontal tracks of the rails 30 and 31 to support the vertical lift housing 44 for horizontal movement between extended or active position, illustrated by FIGS. 1 and 2B, and retracted or passive position under the effects of hydraulic activation of the screw drive members 35 and 36. Walls 42 and 43 of housing 44 are fastened together and reinforced by cross-beams 47, 48 and 49.

Vertical or height adjustment of the coating application carriage 58 is made possible by a second pair of associated vertical screw drive members 50 and 51, shown most clearly in FIG. 3, each having a gear housing 52, 53 attached to the upper end of a vertical rail member, 54, 55 of the housing 44, and being connected to each other for simultaneous reversible operation by means of a drive chain 56 through a hydraulic motor 57.

Vertical lift housing 44 supports the vertically adjustable carriage 58 which comprises a spaced pair of L-

shaped side wall members **59** and **60** fastened together by cross-beams **61, 62** and **63**. The vertical extensions of wall members **59** and **60** are provided with cam follower or wheel pairs **64, 65** which ride within the vertical tracks of rail members **54** and **55** on the inside of housing walls **42, 43** to raise and lower the vertical carriage section **58** under the activation of the screw drive members **50** and **51** since the drive screws **66** and **67** thereof threadably engage nuts **68** and **69**, respectively, which are fastened to the lower ends of the vertical extensions of the L-shaped wall members **59** and **60**.

The horizontal extensions of the L-shaped wall members **59** and **60** of the carriage **58** comprise lower horizontal track members **70** and **71** which support the coating application unit **72** of the carriage for horizontal adjustment therewithin.

Coating application unit **72** of carriage **58** comprises spaced, parallel side frames **73** and **74** fastened together by cross members **75** and **76** and supporting coating applicator roll **77**, pick-up roll **78** positioned to pick up liquid coating composition from the coating pan **79**, and adjustable metering roll **80** positioned to control the amount of coating composition passed by the pick-up roll **78** to the applicator roll **77**. The outer surfaces of the side frames **73** and **74** are provided adjacent the top edge of each with a spaced pair of cam followers or wheels **81, 82** which ride within the horizontal tracks of the track members **70, 71** of the L-shaped wall members **59** and **60**, to support the coating applicator unit **72** for adjustable horizontal movement within the carriage **58**.

As shown by FIG. **2**, movement of the coating unit **72** is controlled by a pair of hydraulic cylinders **83** each attached by a bracket **84** to an L-shapedwall member **59, 60** in horizontal alignment with the track members **70** and **71**, and having their rod end **85** attached to the inside wall of side frames **73, 74** at posts **86**. Activation of the hydraulic cylinders causes the coating unit **72** to move horizontally along track members **70** and **71** to position the leading edge of the applicator roll **77** for coating association with either the coating blanket cylinder **21a**, as shown in FIG. 2B, or the coating plate cylinder **17a**, as shown in FIG. **1**. Preferrably the printing machine frame is provided with spaced pairs of latch posts **87** and **88** or support brackets associated with the location of the blanket cylinder **21a** and the plate cylinder **17a** for engagement within latch brackets **89** attached to the outer surfaces of the horizontal extensions of the L-shaped wall members **59** and **60** in the area of the forward end of the track members **70** and **71**. The engagement of the fixed latch post pair **87** within the latch brackets **89** secures the coating applicator carriage **72** in one position for coating the blanket cylinder **21a**, as shown in FIGS. 2B and **3**, while the engagement of the fixed latch post pair **88**, shown by broken lines in FIG. 2B, within the same latch brackets **89** secures the coating applicator carriage **72** in another position, shown in FIG. **1**, for coating the plate cylinder **17a**. Such engagement requires a presetting of the sequence and duration of operation of the various hydraulic mechanisms. Engagement and disengagement of the latch brackets **89** on posts **87** and **88** requires vertical movement of the carriage **58** within the vertical lift housing **44** by predetermined directional and timed activation of the vertical screw drive members **50** and **51**. Vertical alignment of the latch brackets **89** with the latch post pairs **87** and **88** must first be accomplished. This requires horizontal movement of the vertical lift housing **44** supporting the carriage **58** including the coating applicator unit **72**, and is accomplished by predetermined directional and timed activation of the horizontal screw drive members **35** and **36**, for movement of the vertical lift housing **44** from retracted, non-coating position to extended, aligned position. Movement of the coating applicator unit **72** into coating position requires predetermined directional and timed activation of the horizontal hydraulic cylinders **83**. Adjustable stop members may be incorporated to limit the various movements.

As will be clear to those skilled in the offset printing art, the novel printing and coating apparatus of the present invention enables the modification of a conventional offset printing machine having a plurality of liquid application stations to convert it to a printing and coating apparatus which is adjustable in simple manner for the alternative application of either full coatings or spot coatings. Moreover, such modification may be temporary, if desired, so that the final downstream liquid application station may be used for its intended purpose for the application of printed ink images or for its modified purpose for printing overall or spot coatings. The conversion from printing use to spot coating use merely requires retracting or disengaging the ink applicator roll of unit **20a** to position shown by broken lines in FIG. **1**, replacing the image printing plate on plate cylinder **17a** with a relief coating plate **23**, cleaning the surface of the blanket cylinder **21a** and moving the coating application unit **13** horizontally from retracted position to extended position. If overall or complete coatings are desired it is only necessary to retract or disengage the plate cylinder **17a** from coating association with the blanket cylinder **21a**, without any alteration of the plate cylinder **17a** or its printing plate **23** or ink application unit **20a**.

The present coating applicator roll 77 has a substantially smaller diameter than that of the plate cylinder **17a** or the blanket cylinder **21a**, the diameters of which are equal. The speed of rotation of the applicator roll **77** is adjustable so that its surface speed may be the same as or slower or faster than the surface speed of cylinders **17a** and **21a**, or in reverse rotation thereto, to provide a brushing action relative thereto, if desired. Such brushing action provides a shearing of the coating composition in the nip therebetween, and a relatively heavy or thick direct deposit of coating composition on cylinders **17a** and **21a** in cases where the surface speed of roll **77** is faster than that of roll **17a** or **21a**. This is desirable particularly for the application of spot coatings, since the coating thickness is always split to about one-half as the spot coating is transferred from the relief plate **23** of plate cylinder **17a** to the blanket cylinder **21a**, and further, split to about one quarter when the spot coating is transferred from the blanket cylinder **21a** to the printed copy sheets **16A**. The effect of such inherent splitting is reduced by increasing the coating thickness on the relief areas of plate **23**.

In cases where the coating composition is applied directly to the blanket cylinder **21a**, for the application of continuous coatings to the printed copy sheets **16A**, the plate cylinder **17a** is retracted from contact with the blanket cylinder **21a** so that the only coating split occurs during transfer from the blanket cylinder **21a** to the imaged copy sheets **16A**.

The offset printing machines to which the present invention applies are conventional machines and therefore the present disclosure does not include details regarding the support structure for the various rolls,

dampening units, inking units, sheet conveyor system, drying station, or copy sheet supplying and stacking stations. In most modern printing machines, the sheet conveyor system is not a gripper belt or chain but rather comprises automatic grippers on a series of contacting impression cylinders and transfer cylinders.

Also, the present coating compositions and systems for providing continuous supplies thereof to the coating applicator unit are conventional in the art.

The terms "vertically" and "horizontally" are used herein and in the appended claims to define general directions of movement, including angular vertical movement from one level to another and/or angular movement in the machine direction. For example, on printing machines where the coating plate cylinder is not in perfect vertical alignment above the blanket cylinder it may be preferable that the vertical rail or track of the vertical lift housing is inclined at an angle similar to the angle from vertical formed by a straight line contacting the surfaces of the plate cylinder and the blanket cylinder to be contacted by the coating applicator roll. Movement of the coating carriage along such an inclined vertical rail is both generally vertical and generally horizontal. Similarly the horizontal track members for the support legs of the apparatus and/or for the coating applicator unit may also be angular to provide some degree of vertical movement in cases where the design of the printing machine frame supporting the present apparatus makes it necessary or advantageous.

It is to be understood that the above described embodiments of the invention are illustrative only and that modifications throughout may occur to those skilled in the art. Accordingly, this invention is not to be regarded as limited to the embodiments disclosed herein, but is to be limited as defined by the appended claims.

What is claimed is:

1. An adjustable in-line coating application apparatus for attachment in association with a dowmnstream liquid application station of an offset printing machine having a plurality of liquid application stations, for converting said downstream liquid application station to a coating application station for applying either continuous or spot coatings over the printed surface of a succession of copy sheets carrying ink images printed thereon at one or more upstream liquid application stations, said downstream liquid application station containing a blanket cylinder positioned to contact said plurality of printed copy sheets and an offset plate cylinder in vertical elevation above said blanket cylinder and supported for adjustment into and out of coating association therewith, said coating application apparatus having vertical guide means, a coating carriage attached to said support for substantially vertical movement along said guide means, said carriage comprising a coating application unit, including a container for a supply of liquid coating composition and an elongate coating applicator roll supported to receive a uniform supply of said composition on the surface thereof and to transfer a uniform supply of said composition to the surface of either a plate cylinder or a blanket cylinder in coating association therewith, and mechanical adjustment means for moving said carriage on said guide means relative to said support vertically between elevations corresponding to the locations of the blanket cylinder and the plate cylinder of an offset printing machine in order to move said coating applicator roll into coating association with either said blanket cylinder or said plate cylinder, as desired.

2. An apparatus according to claim 1 in which the support for said coating application apparatus comprises a spaced pair of parallel elongate horizontal leg members designed to be fastened relative to the frame of an offset printing machine.

3. An apparatus according to claim 2 in which said support comprises a parallel pair of spaced vertical wall members which are fastened to each other to form a vertical guide means on a vertical lift housing for said coating carriage.

4. An apparatus according to claim 3 in which said horizontal leg members comprise horizontal tracks, and said vertical wall members are movably attached to said horizontal tracks to permit horizontal adjustment of the position of said vertical lift housing.

5. An apparatus according to claim 4 in which said coating carriage comprises a parallel pair of vertical side members which are fastened to each other to form said carriage, each said side member being supportingly-engaged by a vertical guide means on a wall member of the vertical lift housing for vertical movement of said carriage relative to said housing.

6. An apparatus according to claim 5 in which each of the vertical side members of the carriage includes a lower, horizontal support extension to which the coating application unit is attached.

7. An apparatus according to claim 6 in which the horizontal support extensions comprise horizontal tracks to which the coating applicator unit is attached to permit horizontal adjustment of the coating applicator unit on the carriage relative to the vertical lift housing.

8. An apparatus according to claim 1 in which said coating carriage comprises releasable latching means for securing the unit relative to the frame of an offset printing machine when the carriage is positioned for movement of the applicator unit into coating association with either the blanket cylinder or the plate cylinder.

9. An apparatus according to claim 5 comprising automatic mechanical means for moving said carriage vertically relative to said vertical lift housing, said means comprising a vertical screw drive assembly one end of which is fastened to a vertical side wall of said housing and the other end of which is fastened to an adjacent vertical side member of said carriage.

10. An apparatus according to claim 4 in which said horizontal adjustment of the position of the vertical lift housing is provided by at least one horizontal screw drive assembly one end of which is fastened to a horizontal leg member and the other end of which is fastened to an adjacent wall member of the vertical lift housing.

11. An assembly according to claim 7 which further comprises means for causing horizontal movement of the coating applicator unit relative to the coating carriage, said means comprising at least one horizontal drive member one end of which is fastened to the applicator unit and the other end of which is fastened to the horizontal support extension of the carriage.

12. An offset printing machine having a frame supporting a plurality of in-line liquid application stations, each station comprising a blanket cylinder positioned to contact a succession of copy sheets to apply liquid thereto, and an offset plate cylinder in printing association with said blanket cylinder to apply liquid to prede-

termined areas thereof for transfer to said blanket cylinder and retransfer to said copy sheets, the final downstream liquid application station comprising a liquid coating station for the application of continuous or spot coatings over areas of the copy sheets which are image-printed with ink in at least one upstream liquid application station which is an ink printing station, said liquid coating station having said plate cylinder and said blanket cylinder in vertical elevation relative to each other and comprising a coating application carriage including a coating applicator unit having a container for liquid coating composition and a coating applicator roll which receives a continuous supply of said liquid coating composition from said container, and vertical guide means for supporting said coating application carriage for mechanically-adjustable vertical movement along said guide means between a first coating elevation position in which said coating applicator roll is in coating association with said blanket cylinder and a second coating elevation position in which said coating applicator roll is in coating association with said plate cylinder, whereby said carriage can be moved mechanically to said first position to cause the application of a continuous liquid coating to the image printed surface of the copy sheets, and can be moved mechanically to said second position to cause the application of spot liquid coatings to predetermined limited areas of the image printed surface of the copy sheets.

13. A machine according to claim 12 in which said carriage is movable out of coating association with said blanket and/or plate cylinders and said final downstream liquid application station is adapted for alternative use as another ink printing station.

14. A machine according to claim 12 in which the means for supporting said coating application carriage includes a spaced pair of horizontal leg members designed to support the coating application carriage in association with final downstream liquid application station.

15. A machine according to claim 12 in which the means for supporting said coating application carriage includes a parallel pair of vertical wall members which are fastened to each other and to said guide means to form a vertical lift housing for said carriage.

16. A machine according to claim 15 in which said vertical wall members are movably attached to horizontal track members to permit horizontal adjustment of the position of said vertical lift housing relative to the blanket and plate cylinders.

17. A machine according to claim 16 in which said coating carriage comprises a parallel pair of vertical side members which are fastened to each other to form said carriage each said side member being supportingly engaged by a vertical guide means on a wall member of the vertical lift housing for vertical movement of said carriage relative to said housing and between at least said first and second coating positions.

18. A machine according to claim 17 in which each of said vertical side members of the carriage includes a lower horizontal support extension to which the coating applicator unit is attached.

19. A machine according to claim 18 in which said horizontal support extensions comprise horizontal tracks to which the coating applicator unit is attached to permit horizontal adjustment of the coating applicator unit relative to the coating carriage and the blanket and plate cylinders.

20. A machine according to claim 12 in which the frame of said machine includes first position latching means associated with the blanket cylinder, and second position latching means associated with the plate cylinder in said coating application station, and said coating carriage includes mating latching means which engage said position latching means when the carriage is moved into said first coating position and into said second coating position.

21. A machine according to claim 17 comprising automatic mechanical means for moving said carriage vertically relative to said vertical lift housing, said means comprising at least one vertical screw drive assembly one end of which is fastened to a vertical side wall of said housing and the other end of which is fastened to an adjacent vertical side member of said carriage.

22. A machine according to claim 16 which comprises automatic means for providing horizontal adjustment of the position of the vertical lift housing comprising at least one horizontal screw drive assembly one end of which is fastened to a horizontal track member and the other end of which is fastened to an adjacent wall member of the vertical lift housing.

23. A machine according to claim 19 which further comprises means for causing horizontal adjustment of the coating applicator unit relative to the coating carriage, said means comprising at least one horizontal drive member one end of which is fastened to the applicator unit and the other end of which is fastened to the horizontal support extension of the coating carriage.

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Nov. 21, 1950 W. J. GOETTSCH 2,531,036

APPARATUS FOR APPLYING PATTERN FORMING MATERIAL

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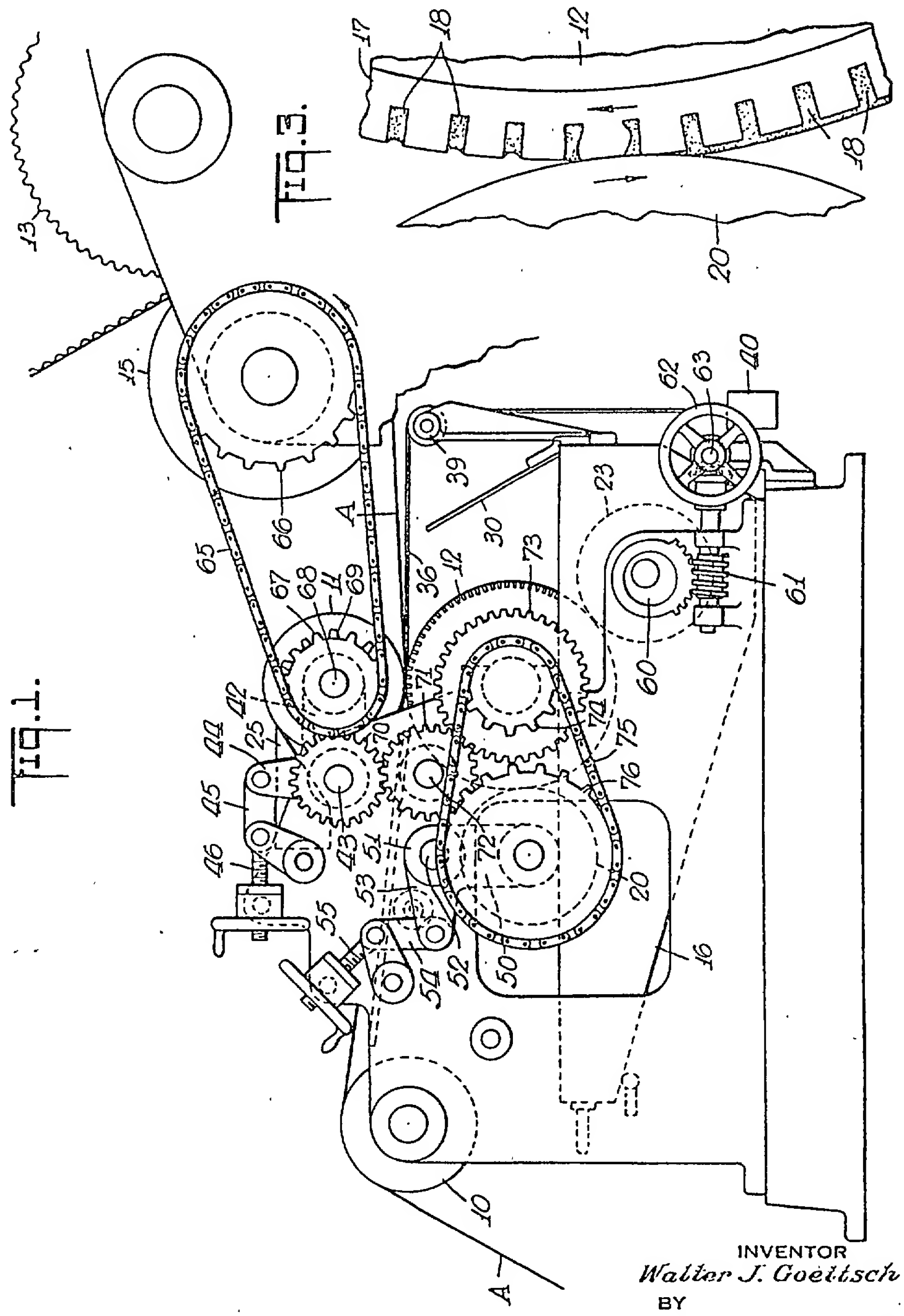

Fig. 3.

Fig. 1.

INVENTOR
Walter J. Goettsch
BY
Dean Fairbank & Hirsch
ATTORNEY

Nov. 21, 1950 W. J. GOETTSCH 2,531,036

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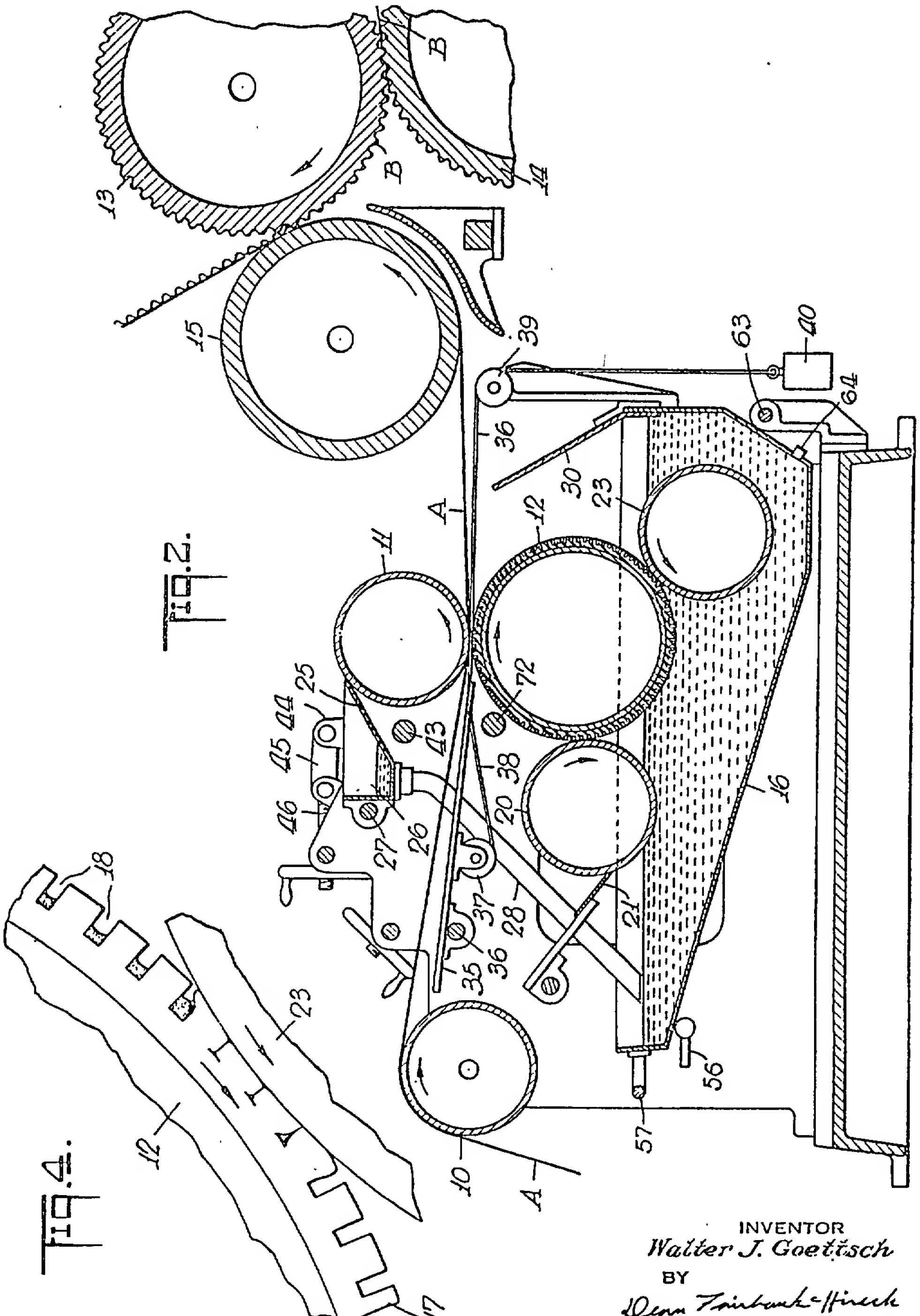

INVENTOR
Walter J. Goettsch
BY
Dean, Fairbank & Hirsch
ATTORNEY

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APPARATUS FOR APPLYING PATTERN FORMING MATERIAL

Walter J. Goettsch, Kenilworth, Ill., assignor to Samuel M. Langston Co., a corporation of New Jersey

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Broadly considered, this invention relates to the forming of repetitive patterns on advancing sheet material, and in its preferred embodiment relates to the manufacture of corrugated paper board formed of a corrugated sheet with the crowns of the corrugations glued to a facing sheet, and by a process and apparatus in which the adhesive is applied to the facing in stripes constituting the repetitive pattern.

In the manufacture of corrugated board of this character the adhesive is commonly applied to the crowns of the corrugations of one sheet while it is held on one of the two corrugating rollers, and the facing sheet is then brought into contact therewith. Machines of this type are shown for instance in the Langston Patents 1,186,997 and 1,642,782, and the Sieg Patent 1,947,066. In this type of machine it is necessary to employ a plurality of guiding fingers or crescents to hold the corrugated sheet in the corrugations of one of the rollers while it is advanced to and brought in contact with the facing sheet, and the adhesive is applied to the corrugations while the sheet is held in place by said guiding fingers. As a result, dry streaks may be left along the sheet corresponding to the positions of the guiding fingers, so that the gluing does not extend continuously across the width of the product. Furthermore, these guiding fingers are usually so formed as to permit the corrugated sheet to "fluff-out" into contact with the adhesive applying roller, as shown in said Sieg Patent 1,947,066. The extent to which the sheet fluffs out varies with the speed of operation of the machine and with the stiffness and thickness of the corrugated sheet.

The adhesive may be applied as a stripe pattern to the facing sheet, as shown for instance in my Patent 2,051,296, and in the Sieg Patent 2,051,319. In machines of this type the transverse stripes on the facing sheet are in such position and spacing as will insure registration with the crowns of the corrugations of the corrugated sheet when the two are brought together.

Where the adhesive is picked up by one corrugated roll and transferred therefrom to a second corrugated roll meshing therewith, and then transferred from the second roll to the sheet, as shown in my Patent 2,051,296, it is difficult to insure the application of the same amount of adhesive to each stripe, as varying amounts may remain on the ridges, depending in part on the speed of rotation and the action of centrifugal force. In the Sieg Patent 2,051,319 there is provided a pick-up roll, a transfer roll, and a separate fluid cleaning corrugated roll for cooperation with the corrugated roll which applies the adhesive to the facing sheet.

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The main object of the present invention is to provide means for varying and accurately controlling the amount of adhesive applied as a pattern to an advancing sheet to insure the application of the desired amount of adhesive at the desired points, and independent of variations in the speed of operation of the machine.

A further object is to provide simple means for regulating at will the amount of pattern forming material applied to the sheet, and to apply it in the desired pattern without liability of leaving undesirable dry streaks or gaps.

As an important feature of my invention there is provided a transfer roller which has an outer surface portion of resilient material, and provided with pockets or recesses of a design, shape and spacing corresponding with the stripes or other desired pattern to be formed on the sheet material. The roller is so mounted that it is partially immersed in the supply of adhesive or other pattern forming material, and upon rotation carries material in the pockets to the point where the roller engages the sheet material on which the pattern is to be formed.

As a further important feature, means are provided whereby the amount transferred to the sheet may be varied at will as the sheet is pressed into contact with the surface of the roller. By varying the degree of pressure the resilient material is distorted and the pockets are partially collapsed to a varying degree, and thus more or less of the material is forced out of the pockets onto the sheet.

As a further feature, means are provided for partially collapsing the pockets to force out a small portion of the material and thus insure that none of it flows out onto the surface of the roller while being brought to the point where the roller contacts the sheet, and at the same time cleaning the surface of the transfer roller intermediate of the pockets.

A further object of the invention is to insure the uniformity of the material applied to the sheet. This is effected by substantially completely collapsing the pockets after they leave the sheet, so as to remove all residual material therefrom and insure the refilling of the pockets with fresh material from the source of supply.

These objects may be accomplished by the use of three rollers at spaced points around the periphery of the transfer or adhesive applying

roller, and adjustable to press against the latter to the desired extent.

The roller which substantially completely collapses the pockets may be mounted in the container and contact with the transfer roller below the liquid level of the adhesive. The roller which cleans the surface of the transfer roller may contact with the latter above the liquid level and may rotate in the same direction, so that it acts to partially collapse and remove excess material from the pockets, and also acts as a wiper. The third roller, which is mounted above the transfer roller, and which presses the sheet against the transfer roller, controls the amount of adhesive applied, as by varying the pressure the pockets may be collapsed to the required extent to force out the desired amount of adhesive.

As a further feature, the sheet is guided between the adhesive transfer roller and the upper pressure roller by a series of fine parallel wires which are sufficiently small to prevent the leaving of any dry streaks on the sheet. The pressure causes them to be partially embedded in the resilient material of the transfer roller without leaving any permanent grooves in said resilient material.

In the accompanying drawings there is illustrated one embodiment of my invention. In these drawings:

Fig. 1 is a side elevation of the apparatus.

Fig. 2 is a vertical longitudinal section through the apparatus.

Fig. 3 is a section corresponding to a portion of Fig. 2, but on a very much larger scale, and

Fig. 4 is a section corresponding to another portion of Fig. 2, and also on a larger scale.

In the specific apparatus illustrated, a sheet A on which the pattern is to be formed, is delivered over a roller 10, thence between a pair of rollers 11 and 12 where the pattern is formed on the sheet. If the sheet is to be the facing sheet of corrugated paper, a second sheet B may be corrugated in any suitable manner, as for instance by passing between the usual type of corrugating rollers 13 and 14, and the facing sheet A is pressed against the corrugated sheet B while the latter is still on the corrugated roller 13, by means of a roller 15.

In my improved apparatus the roller 12 is mounted so that its lower portion dips into the adhesive or other pattern forming material in a container 16, and the roller 11 is mounted directly above the roller 12. This roller 12 constitutes the transfer roller for applying the adhesive or other pattern forming material in the desired pattern on the lower surface of the sheet A.

As an important feature of the present invention the roller 12 has a peripheral portion 17 which is formed of rubber, synthetic rubber, or other suitable resilient material, and in the peripheral surface of this resilient layer there are formed a series of pockets 18 which receive the liquid or other flowable pattern forming material from the container 16 and transfer it to the sheet A. In the manufacture of corrugated paper these pockets are in the form of grooves or channels extending lengthwise of the roller and spaced apart to a distance equal to the distance between the crowns of the corrugations of the sheet B. As the roller 12 rotates it picks up adhesive from the container 16 and carries it up to and applies it onto the under surface of the sheet A.

The adhesive may be a relatively thick viscous

material, and will adhere to the surface of the roller between the pockets as well as filling the latter, and may tend to flow out of the pockets onto the surface.

As one feature of my invention I provide a roller 20 which presses against the resilient surface portion 17 of the roller 12 as shown in Figs. 2 and 3. By rotating both the roller 20 and the roller 12 clockwise, the surface of the former will move down in rubbing or wiping contact with the surface of the latter to wipe said surface clean, and preferably it has a lower peripheral speed than that of the roller 12, particularly where the mechanism is to be operated at high speed. At the same time, the roller 20 is pressed against the resilient surface to partially collapse the pockets in succession, as shown in Fig. 3, so as to force some of the material out of the pockets, leave the meniscus of the remaining material slightly below the peripheral surface of the roller, and reduce the liability of any material flowing out of the pockets onto the surface on the way from roller 20 to the point of transfer of the material to the sheet A. The pressure of the roller 20 against the roller 12 may be varied at will, as hereinafter described. To keep the surface of the roller 20 clean there is provided a suitable scraper 21 acting on said surface on the up-moving side.

The roller 11 presses the advancing sheet A onto the surface of roller 12 with sufficient pressure to partially collapse the pockets and to bring the meniscus of the material up to or slightly above the peripheral surface, and thus into contact with the sheet. By varying the pressure applied to the roller 11, the amount transferred to the sheet may be varied at will, and the proper amount applied so as to give good adhesion between the sheets A and B where they come together between the rollers 13 and 15. The rollers 10, 13, 14 and 15 will normally be heated by the use of steam, which heat aids in the settling of the adhesive and the evaporation of volatiles therefrom. If desired, additional heating means may be employed.

As all of the material is not forced out of the pockets by the pressure of the roller 11 and the absorption onto the sheet, the residual amount might carried around on the roller 12 and might dry or harden in the pockets when the machine is stopped. To prevent this action a roller 23 is provided and pressed against the roller 12, preferably on the down-moving side or the lower side, and preferably below the liquid level in the container 16. The pressure applied by this roller 23 is greater than that applied by the rollers 20 or 11, and is such as to substantially completely collapse the pockets as shown in Fig. 4. Thus all of the residual material is ejected from the pockets, and as they open up again they take in a fresh supply from the container. Preferably the roller 23 is completely immersed in the adhesive.

As the sheet A may be of any desired width, and in some cases may be substantially narrower than the length of the roller 12, some of the adhesive ejected from the pockets may come into direct contact with the roller 11. The same will happen if the sheet A should break or have a hole in it, or when the end of the sheet is reached. To remove any such adhesive from the roller 11 there is provided a scraper 25 which may form one wall of a trough 26 pivoted at 27 so as to press it against the surface of the roller 11, and

having a drain pipe 28 leading back to the container 16.

A splash board 30 may be provided to catch and return to the container any liquid thrown out by the rollers 12 and 23 if the machine be operated at high speed.

To guide the end of the sheet A in threading up, and to prevent the end from dropping into the container if the sheet breaks, guiding means is employed. This is shown as a guide board 35 pivoted at 36 near the roller 10 and extending substantially to the roller 12 near the upper side of the latter. Secured to the under side of this board is a bar or spindle 37 on which are wound a plurality of fine wires 38. These wires extend below or through the free end of the guide board 35 and then between the rollers 11 and 12 over a roller 39 to weights 40. Thus the wires are kept taut and will support the sheet A beyond the roller 12 in threading up, or if the sheets break. When the roller 11 is raised this also causes the free end of the guide board 35 to raise. The raising of the free end of the guide board 35 and the wires attached thereto lifts the sheet of material A out of engagement with the roller 12 whenever the roller 11 is raised.

The wires are preferably very fine so that they may be pressed into the resilient surface of the roller 12 by the action of sheet A and roller 11, and do not prevent the proper application of the adhesive to the sheet A or leave any dry streaks on the sheet. If the wires wear from friction with the sheet, or if they break, another portion may be unwound from the bar or spindle 37 and the weights 40 reattached.

Various means may be employed for mounting the rollers 11, 20 and 23 so as to facilitate varying the pressure on the roller 12. As shown in Fig. 1, the roller 11 is mounted on bell crank levers 42 pivoted at 43. The upper arms 44 are connected by a link 45 to an adjusting screw 46, so that the roller 11 may be lifted or pressed down with the desired pressure. The roller 20 is also mounted on the depending arms 50 of bell crank levers 51 pivoted at 52, and the outer arms 53 are connected by links 54 to an adjusting screw 55. The roller 23 is shown as mounted on an eccentric bearing 60 which may be rotated by a worm 61 to move the roller 23 toward and from the roller 12.

The worm may be rotated by any suitable means, as for instance a hand wheel 62 on a shaft 63 connected to the shaft of the worm wheel by bevel gears.

The container may have a drain outlet 64 if desired, and may be pivotally supported on the axis of the roller 23 and supported by a pin 56. By removing this pin the container may be lifted or lowered by a handle 57.

The roller 10 may be an idler and the roller 23 may be rotated by reason of the pressure applied by the roller 12, but the rollers 11, 12 and 20 are driven in timed relationship to the roller 15, and from the shaft of that roller. As shown, the rollers 11 and 15 are connected by a chain 65 and sprockets 66 and 67, the latter being on the shaft 68 of the roller 11. On the same shaft is a gear 69 which meshes with an idler 70 on the pivot 43 of the bell crank 42, and this idler meshes with a second idler 71 on a spindle 72, which idler 71 meshes with a gear 73 connected to the roller 12. Connected to this gear 73 is a sprocket wheel 74 connected by a chain 75 to a sprocket wheel 76 on the shaft of the roller 20. The relative pitch diameters of the sprocket wheels 74 and 76 are such in respect to the relative diameters of the rollers 20 and 12 that the roller 20 has a somewhat lower peripheral speed than the roller 12, so as to give the wiping action hereinbefore referred to.

It is of course important that the stripes be applied to the sheet A in such positions that they will register with the corrugations on the sheet B. Therefore, the roller 11 and gear 69 are rotatably adjustable in respect to the sprocket wheel 67. Furthermore, this adjusting means should be of a type which can be operated while the machine is running. The details of such a running register form no portion of my invention, and may be of the type shown in my Patent 2,051,296, hereinbefore referred to.

Although the invention is illustrated only in connection with a machine for making corrugated board, the sheet A need not be delivered to a corrugated sheet, the pockets on the roller may be so shaped as to apply the pattern forming material in any desired design, and the pattern forming material need not be an adhesive, but may be a printing paste or any other material for forming a pattern on advancing sheet material. This sheet material need not be a continuous sheet, but may be separate sheets fed in succession, as in a printing press.

In the making of corrugated paper, the grooves may be 1/16 of an inch wide and 1/8 of an inch deep, so that a narrow stripe of adhesive is applied, but the grooves contain at least three times the volume of adhesive applied as a single stripe. The surface tension of the side walls and bottoms of the grooves will hold the adhesive in place even at high speed, thus preventing spray or bead formation.

Different kinds of adhesive require the application of different amounts, and by varying the pressure on the roller the proper amount of any particular adhesive may be applied.

For applying patterns in the making of products other than corrugated paper, the pockets may be of any desired shape, for instance they may be circular and close together, to apply the material as a stippled pattern, for instance in machines for combining or laminating sheets, or making linings.

The cleansing roller 23 may be omitted if the material is of a character that does not harden or change in composition or character when exposed to the air.

In the foregoing description I have referred to the material in the container 16 as adhesive, but it will be obvious that it may be only one constituent or reactant which will unite with another constituent or reactant to form the desired adhesive. In many cases a quick-setting water resistant adhesive is very desirable, but very few such adhesives are available, and those are too expensive. A quick-setting adhesive is particularly important in the operation of high speed machines, but a quick-setting adhesive dependent on chemical reaction cannot be used in the ordinary corrugating equipment, as the reaction would take place before the adhesive reached the sheet. The mechanism I have illustrated might be employed for applying the main constituent of the adhesive, and the other constituent or setting agent might be applied by a second unit of the same type operated in timed relationship therewith, or in any other suitable manner, as for instance by applying it to the crowns of the corrugations of the sheet while the latter is on the roller 13. Thus the two constituents or re-

actants would come together only where the sheets come together. As an example, casein might be applied by the apparatus illustrated, and formaldehyde thereafter applied to very rapidly effect the setting and the formation of a waterproof adhesive.

In some cases it is desirable to employ two different adhesives, one quick-setting and the other slow-setting, as disclosed in the Hill Patent 2,384,676 (Re. 22,842). The apparatus herein illustrated may be employed for applying one of the adhesives to the liner sheet only at those points which would come directly into contact with the parts of the corrugations or flutes which have already received the other adhesive or a chemical which will react with the applied adhesive.

The apparatus may be employed for various other purposes.

Having thus described my invention what I claim a new and desire to secure by Letters Patent is:

1. An apparatus for applying pattern forming material to an advancing sheet, including a container for the pattern forming material, a roller for applying said material, said roller having a horizontal axis and having its peripheral portion formed of a layer of resilient material with alternate longitudinally extending ridges and grooves in the outer surface thereof, each of said ridges presenting a smooth, substantially flat outer surface, said roller being positioned with its axis above and its lower portion beneath the level of the material in said container, a member contacting with the surfaces of said ridges after the latter move upwardly above the level of the material, thereby to wipe material from said surfaces, and means above said roller for pressing an advancing sheet into contact with the surfaces of the ridges of the roller to transfer stripes of material from said grooves to said sheet.

2. An apparatus for applying pattern forming material to an advancing sheet, including a container for the pattern forming material, a roller for applying said material, said roller having a horizontal axis and having its peripheral portion formed of a layer of resilient material with alternate longitudinally extending ridges and grooves in the outer surface thereof, each of said ridges presenting a smooth, substantially flat outer surface, said roller being positioned with its axis above and its lower portion beneath the level of the material in said container, a second roller in said container and having its axis parallel to that of said first mentioned roller and beneath the level of the material, said rollers having their axes so spaced that the second mentioned roller is rotated by frictional contact with said first mentioned roller and applies pressure to the outer surfaces of said ridges to substantially collapse said grooves while below the level of the material and expel material from said grooves and thereafter permit said grooves to open and refill with material, a third roller having a smooth peripheral surface contacting with and movable in the opposite direction from that of the adjacent surfaces of said ridges after the latter move upwardly above the level of the material, thereby to wipe material from said surfaces, and means above said first mentioned roller for pressing an advancing sheet into contact with the surfaces of the ridges of the first mentioned roller to transfer stripes of material from said grooves to said sheet.

WALTER J. GOETTSCH.

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Dec. 26, 1967 C. R. RHORER 3,360,393

METHOD OF MAKING COCKLED PAPER

Filed April 30, 1964 2 Sheets-Sheet 1

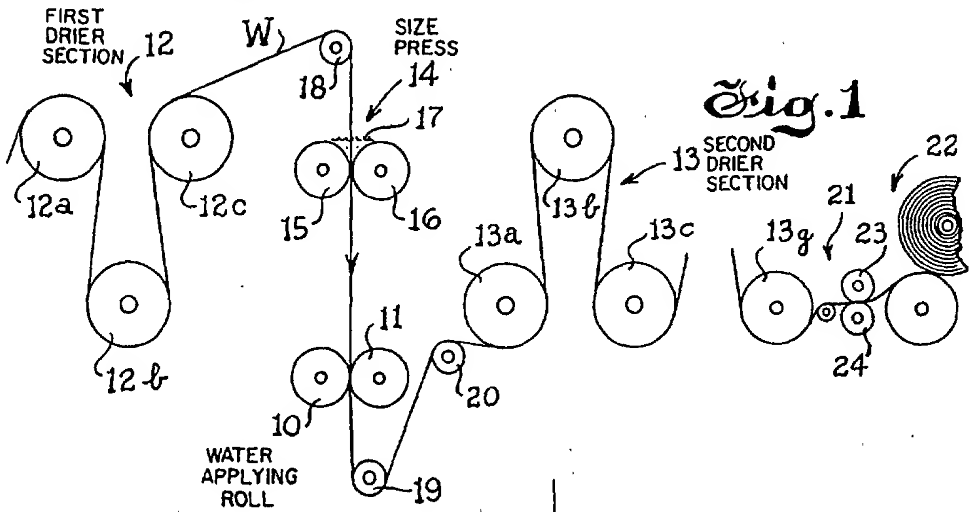

Fig.1

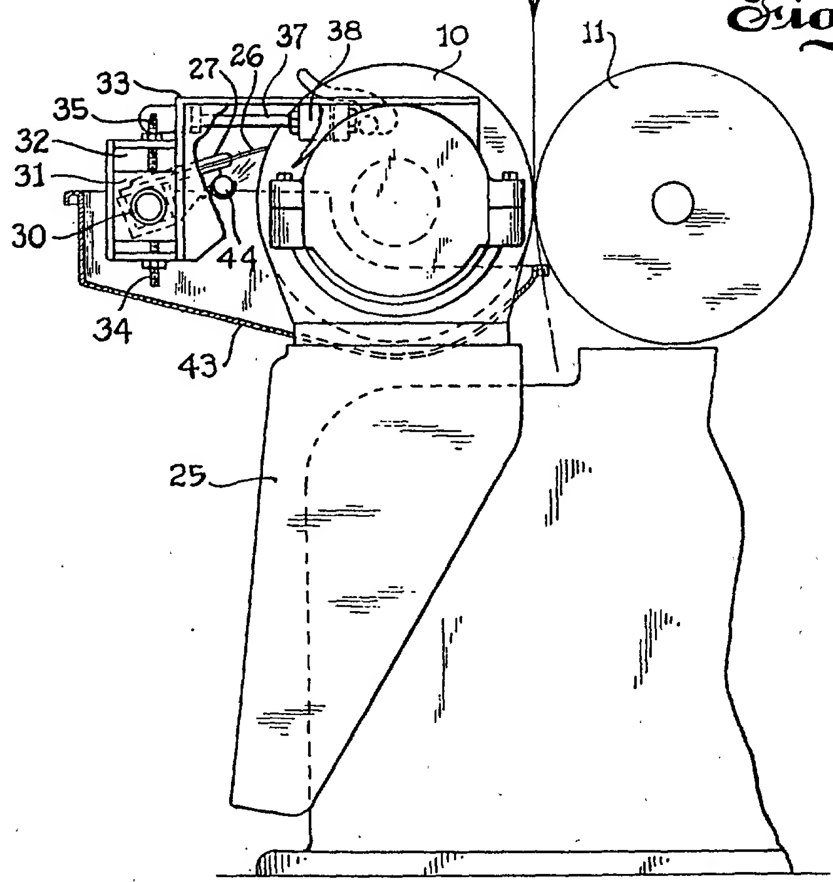

Fig.2

Dec. 26, 1967 C. R. RHORER 3,360,393

METHOD OF MAKING COCKLED PAPER

Filed April 30, 1964 2 Sheets-Sheet 2

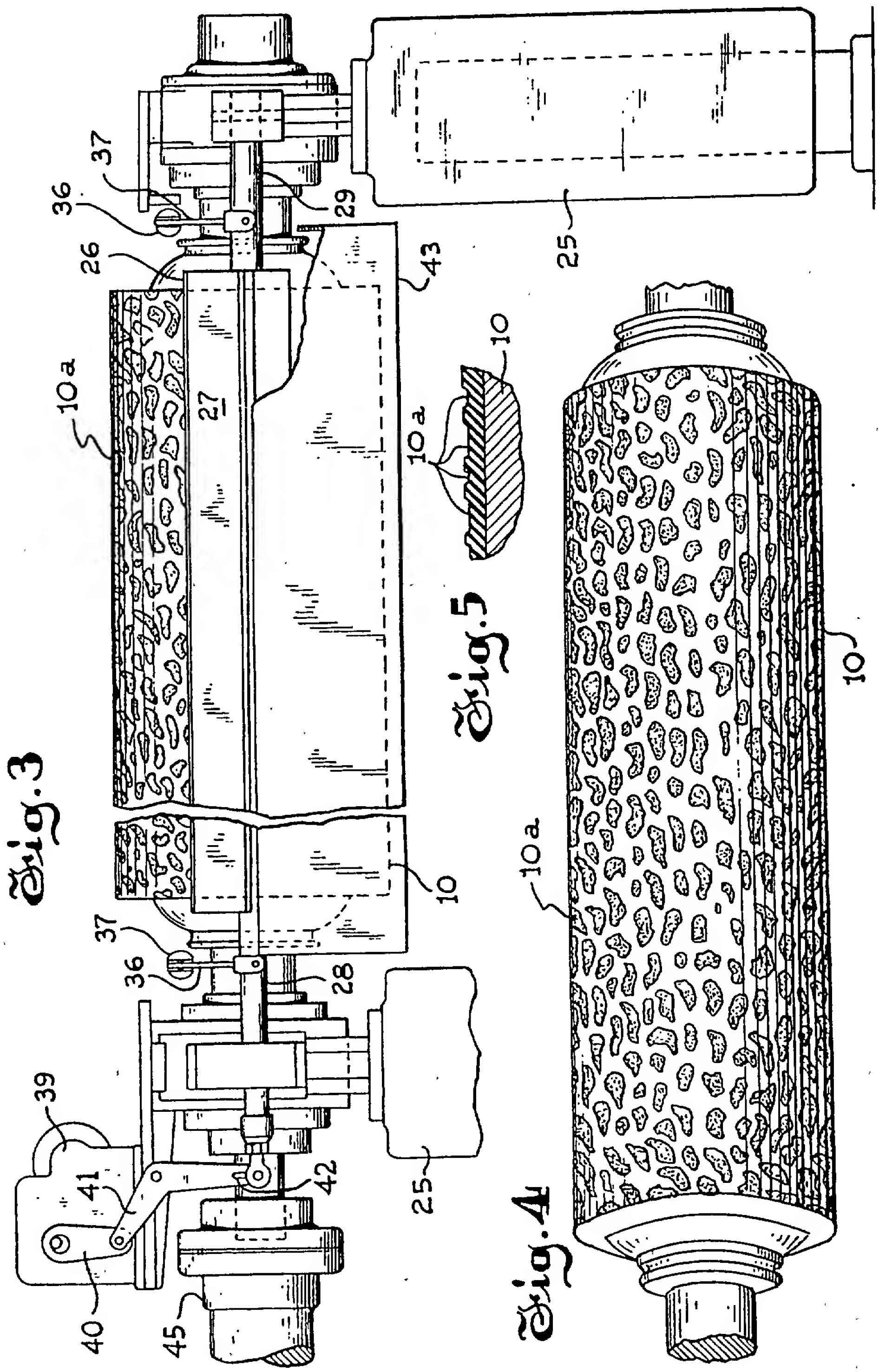

Fig.3

Fig.4

Fig.5

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3,360,393
Patented Dec. 26, 1967

3,360,393
METHOD OF MAKING COCKLED PAPER

Cecil R. Rhorer, Neenah, Wis., assignor to Kimberly-Clark Corporation, Neenah, Wis., a corporation of Delaware

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3 Claims. (Cl. 117—38)

ABSTRACT OF THE DISCLOSURE

A paper cockling apparatus including a rotating roll having depressions in its peripheral surface for holding water for transfer onto separated spots of a paper web passing over the roll and drying apparatus for drying the paper web as so wetted.

The invention relates to the manufacture of paper and, more particularly, to a method and apparatus for producing a paper having a cockled finish.

Prior to my invention, cockle finished paper has generally been made off or separate from the papermaking machine. Previously manufactured, smooth finished, paper has been drawn from reels through a size bath; and the paper has then been air dried, such as by means of the well-known festoon drier which supports the paper in the form of loops between traveling spaced rods. The cockles in the paper, which are spots that are warped or bulged from the general plane of the sheet, are produced on account of excessive and uneven shrinkage during drying.

It is an object of the present invention to provide an improved method and apparatus for manufacturing cockled paper which does not require air drying, such as by means of the festoon drier, and which is, therefore, considerably more economical to use than prior methods and apparatus.

In brief, according to the invention, it is proposed that cockle finished paper be produced by applying measured quantities of water onto a paper web in spots that are irregularly spaced, sized and shaped and they drying the web, preferably by passing the web through a conventional drier drum section. Preferably, the web is drawn through a sizing bath before the application of the water, and preferably the water is applied in such irregular spots by means of a yieldable roll having an intaglio peripheral surface, the surface including irregularly spaced, sized and shaped spots etched out of the roll surface for carrying measured amounts of water within them for application onto the web.

The invention consists of the novel methods and constructions to be hereinafter described and claimed, for carrying out the above stated objects, and such other objects, as will be apparent from the following description of a preferred mode of practicing the invention, illustrated with reference to the accompanying drawings, wherein:

FIG. 1 is a fragmentary, diagrammatic, side elevational view of a portion of a papermaking machine incorporating the apparatus of the invention for producing cockled paper and which includes a pair of nipped rolls, one having a yieldable intaglio surface;

FIG. 2 is an end view of the nipped rolls, together with a supporting frame;

FIG. 3 is a side view of the rolls and associated structure;

FIG. 4 is a perspective view of the roll with the intaglio surface; and

FIG. 5 is a fragmentary, longitudinal, sectional view of the intaglio surfaced roll.

Like characters of reference designate like parts in the several views.

Referring in particular to FIG. 1, the cockling mechanism of the invention may be seen to comprise a cylindrical roll 10 which has a resilient peripheral surface and which has a nip with a relatively unyieldable cylindrical backup roll 11. The nipped rolls 10 and 11 are disposed in a papermaking machine between a bank 12 of can driers and a second bank 13 of can driers. The drier bank 12 comprises a series of cylindrical, rotatable, steam heated drier drums, including the illustrated drums 12*a*, 12*b* and 12*c*. The drier bank 13 comprises a series of cylindrical, steam heated, rotatable drums, including the illustrated drums 13*a*, 13*b*, 13*c* and 13*g*.

A horizontal size press 14 is located over the nipped rolls 10 and 11, and the size press comprises a pair of rolls 15 and 16 having a nip between them. A source of paper sizing, which is made up principally of starch and water, is connected to provide a pond 17 of the sizing in the nip between rolls 15 and 16.

A paper web W is carried by the drums 12*a*, 12*b* and 12*c*. Suitable guide rolls are provided for the web W, and, as illustrated in FIG. 1, these comprise a guide roll 18 for directing the web W between the rolls 15 and 16 and guide rolls 19 and 20 for receiving the web W from the rolls 10 and 11 and for directing the web around the drier drum 13*a*.

The web W, after leaving the last can drier 13*g*, may be passed through a calender stack 21 to a winder 22. The calender stack 21 is of conventional construction and, as shown, comprises a pair of steel rolls 23 and 24 between which the paper web W passes, and the winder 22 is also of any conventional construction.

The roll 11 is suitably mounted so as to be rotatable on a fixed axis. The roll 10 is rotatably mounted with respect to a fixed frame 25, and a doctor blade 26 is also mounted with respect to the frame 25 so that the blade 26 is in doctoring relation with respect to the peripheral surface of the roll 10. The blade 26 is carried by a blade holder 27 disposed on a pair of opposite shafts 28 and 29. The shafts 28 and 29 are rotatably mounted in bearings 30 which are fixed within bearing housings 31. The bearing housings 31 are adjustably disposed in receiving cavities 32 provided in a fixed frame 33, and adjusting screws 34 and 35 hold the bearing housings 31 in proper vertical positions within the cavities 32.

Arms 36 are fixed onto the shafts 28 and 29, and these arms are connected by means of links 37 with conventional mechanism 38 for adjustably fixing the ends of the links with respect to the frame 25. The connections between the links 37 and the arms 36 are sufficiently loose so as to permit longitudinal oscillation to a slight extent of the blade 26 and of shafts 28 and 29 in the bearings 30.

The blade 26 is oscillated by means of a motor 39 of conventional construction which has a swinging oscillating arm 40 on its exterior. A bell crank 41 is pinned to the arm 40 at one end of the crank and has a pin and slot connection 42 at its other end with the shaft 28.

A water pan 43 is disposed beneath the roll 10 and beneath the blade 26 and blade holder 27. A water shower pipe 44 is fixed to the bottom of the blade holder 27 and has outlets for spraying water onto the surface of the roll 10 beneath the blade 26.

The various can driers 12–12*c* and 13*a*–13*g* in the banks 12 and 13 are driven from any suitable source of power, and the rolls 10, 11, 15, 16, 23 and 24 are also preferably driven. The roll 10 is driven from a suitable power source by means of a coupling 45.

The backup roll 11 has a relatively hard peripheral surface, and the roll 10 has a relatively soft peripheral

surface. The surface of the roll 10 may, for example, have a hardness of 120, Pusey & Jones Plastometer (1/8 inch ball). The roll 10 is provided on its outer surface with a plurality of spaced discrete indentations 10*a*, which may, for example, have depths of about .006 inch. The peripheral surface of the roll 10 is otherwise cylindrical, so that the doctor blade 26 has a smooth running contact with the roll 10 as the roll turns. The roll 10, thus, may be considered to have an indented, intaglio, cylindrical surface.

The intaglio outer surface of the roll 10 may, of course, be formed in a number of ways. One manner of forming that has been found successful includes the use of a plane zinc plate which is etched with the pattern that is intended to be provided on the surface of the roll 10. A paper mat is applied onto the zinc plate after etching in order to make a mold for molten rubber, and the molten rubber is then poured onto the zinc plate and is set. A relatively thin molded rubber mat of about 1/8 inch thickness, for example, is thus obtained from the zinc plate; and this is applied and is caused to adhere by suitable gluing composition on the exterior surface of the roll 10 which is otherwise of relatively hard material, such as hard rubber. As is apparent from FIG. 4, the indentations 10*a* in the yieldable surface roll 10 are, preferably, of haphazard shapes; however, they may, for example, be about 1/8 inch width and 1/2 inch length. The roll 10 may, for example, have an 18 inch diameter, but its diameter is not critical. The roll 10 has a length slightly greater than the width of the web W, and may, for example, have a length of 120 inches with an 18 inch diameter, without excessive bending of the roll in operation (in this connection, it may be noted that the roll 10 is illustrated in FIG. 4 as being of less length in relation to its diameter than just given, and that the indentations 10*a* are shown larger with respect to roll diameter than has been mentioned above, these variations being only for the purpose of better illustration).

In operation, the web W passes over the driers of the bank 12 and is in substantially dry condition. The web W then passes through the horizontal size press 14, between the rolls 15 and 16 and through the size pond 17, and is thus substantially wetted with size. After such passage through the size press it may, for example, consist of about 50 percent moisture. The web W then passes between the rolls 10 and 11. The intaglio roll 10 is preferably driven from the coupling 45 to have the same peripheral speed as the linear speed of the web W, and during its rotation the indentations 10*a* receive water from the pan 43 and from the shower 44. The pan 43 preferably maintained partially filled with water so that the roll 10 is partially immersed in water as it turns through the pan 43. The doctor blade 26 doctors off substantially all of the water on the portions of the peripheral surface of the roll 10 between and bounding the indentations 10*a*, and each of the indentations 10*a* receive and hold bodies of water which are limited in depth by the bottoms of the indentations and by the blade 26 passing across the indentations 10*a* and which are thus of substantially the same depth as the indentations. The water held by the indentations 10*a* passes onto the relatively moist wetted web W from the horizontal size press 14 as the web W passes between the rolls 10 and 11, and this action is accentuated by the fact that the rolls 10 and 11 are under substantial pressure so that distortion of the relatively yieldable surface of the roll 10 takes place. A significant portion of the water, for example, about half of the water, contained by the indentations 10*a*, thus, transfers onto the web W, although the indentations retain a small amount of water after turning through the nip of the rolls 10 and 11. The effect of the intaglio roll, thus, is to add additional water onto areas of the web W which pass over the haphazardly shaped and spaced indentations 10*a* and which areas are thus of haphazard size and shape; and the rest of the roll surface that has been doctored substantially free of water does not provide any substantial additional wetting of the web.

The web W passes from the rolls 10 and 11 onto the driers of the drier bank 13, and these driers again dry the web so that it contains about 5 to 10 percent moisture, which is that dryness that finished paper web ordinarily has. The wetted spots of the web W that have passed over the indentations 10*a* dry later than do the other portions of the web W, and this retardation of drying of the haphazardly spaced and shaped web portions has the effect of producing a relatively rough, uneven paper web which is substantially the same as that produced by the lofting operation previously mentioned.

The thickness of the doctor blade 26 or the pressure which it bears on the surface of the intaglio roll 10 does not seem particularly critical; however, it has been found, for example, that a blued steel blade having a thickness of .012 inch which protrudes behind its holder 27 by about 2 inches is quite satisfactory. The shower 44 need not be used during ordinary operation of the intaglio surfaced roll 10, since the indentations 10*a* fill with water while passing through the pan 43; the shower 44, however, may be very useful in cleaning out the indentations 10*a*. It is contemplated that sizing solutions may also be supplied to the pan 43, if desired; and in this case, in particular, it is desirable to use the shower 44 for cleaning out the indentations 10*a*.

The intaglio surfaced roll 10, thus, advantageously applies additional water to the previously sized, moist web W in discrete areas which dry later than the other areas of the web as the web subsequently passes through the drier bank 13. The roll 10, thus, has the effect of printing water onto the previously sized web W in discrete areas in metered amounts, similar to the printing action of a rotogravure printing roll using ink, thus slowing down the drying in those areas of the web in which the water is transferred from the indentations 10*a*. A cockling effect of the resultant paper web is thus obtained without the use of expensive lofting apparatus.

I wish it to be understood that the invention is not to be limited to the specific constructions and methods as above described, except only insofar as the claims may be so limited, as it will be understood to those skilled in the art that changes may be made without departing from the principles of the invention. In this connection, it will be apparent that the intaglio surfaced roll 10 may have a relatively hard surface instead of a soft surface as mentioned above. With this change, the roll 11 would be provided with a relatively soft surface instead of a hard surface. With these modifications, the roll 11 will yield in the vicinity of the nip between the rolls 10 and 11, while there will be substantially no yielding of the roll 10; and the soft surfaced roll 11 will assure intimate contact of the paper with the water containing cells 10*a* in the roll 10 to provide substantially the same application of water to the haphazardly spaced areas of the web as previously described.

What is claimed is:

1. In a method of making cockled paper, the steps which comprise, running a web of paper over the outer surface of a rotating roll that is provided on its surface with spaced depressions, preliminarily filling said depressions with water before application of the web to the roll so that the water transfers onto the paper web from the depressions as the web travels over the roll, and then drying the paper web.

2. In a method of making cockled paper, the steps which comprise, applying sizing onto a traveling web of paper, thereafter passing the web of paper over the outer surface of a rotating roll that is provided on its outer surface with irregularly sized, spaced and shaped depressions, preliminarily filling said dpercessions with water before the roll surface contacts the web so that the water within the depressions transfers onto the paper web, and then drying the paper web.

3. In a method of making cockled paper, the steps which comprise, running a web of paper over the surface of a rotating roll that is provided on its surface with irregularly sized, spaced and shaped depressions of substantially the same depth, preliminarily filling said depressions with water and doctoring off the excess water from the surface of the roll before the web passes over the roll so that the water within the depressions transfers onto the paper web, and then drying the paper web.

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MURRAY KATZ, *Primary Examiner.*

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Aug. 20, 1968 J. DE LIGT 3,397,675

COATING APPARATUS

Filed March 13, 1967

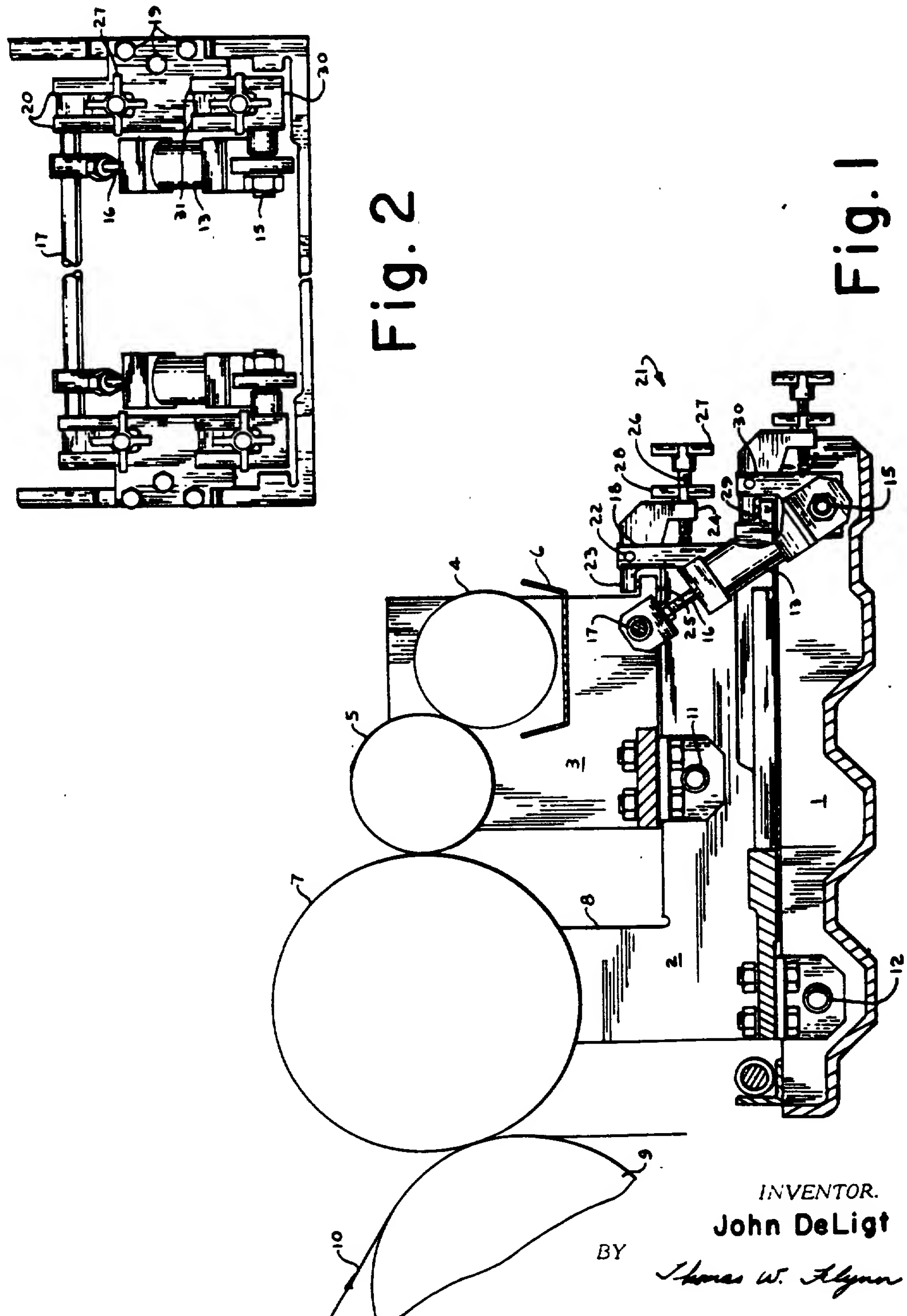

Fig. 2

Fig. 1

INVENTOR.

John DeLigt

BY Thomas W. Flynn

ATTORNEY

United States Patent Office

3,397,675

Patented Aug. 20, 1968

3,397,675

COATING APPARATUS

John De Ligt, Covington, Va., assignor to West Virginia Pulp and Paper Company, New York, N.Y., a corporation of Delaware

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3 Claims. (Cl. 118—258)

ABSTRACT OF THE DISCLOSURE

A coating or printing station having its applicator and transfer rolls attached to pivotally mounted supporting frames so that the rolls may be moved into and out of operative position. Adjustable, lost motion stops are provided interconnecting the supporting frames so that the frames may be pivoted serially by means of a single source of power and the operative positions of the rollers preset by adjusting the stops.

BACKGROUND OF THE INVENTION

Field of the invention.—Actuating systems for moving the rollers of a rotary coater or printer into and out of operative positions.

Description of the prior art.—In a conventional form of rotary coater or printer, the coating material is picked up from a supply tray or pan by a pickup roll and distributed by the pickup roller over the surface of a transfer roller. The transfer roller then transfers a layer of coating to an applicator roll which applies the coating to a web of material carried past the applicator roller by a backup roll.

In practice, the pickup and applicator rolls may be resiliently surfaced and the transfer roll provided with a relatively hard etched surface. Depending upon the surface configuration of the applicator roll, the coating may be applied to the web in either a continuous or patterned layer. In this regard it should be noted that the terms coater, coating and the like are used herein in their generic

In this type of operation it is necessary to maintain a continuous layer or coating.

In this type of operation it is necessary to maintain a desired pressure or spacing, between the web being treated and the applicator roll and between each of the rolls. It is also desirable to be able to withdraw the applicator roll from the web and at least the transfer roll from the applicator roll when the coating operation is temporarily discontinued and to return the rolls to exactly their former positions when coating is again commenced. Additionally, it is necessary that these pressures or spacings be capable of adjustment to suit the requirements of specific operations.

In a known form of actuating system intended to accomplish these results, the frames for the applicator and transfer rolls are each mounted on trackways and an eccentrically mounted shaft, actuated by a hydraulically powered linkage system, is provided for each frame to slide the frames along their respective trackways and thereby move the rolls into and out of their operative positions.

It will be apparent that in this type of actuating system the contacting portions of the frames and trackways must be finished with precision and maintained in this condition to insure a smooth sliding action. It will also be apparent that the provision of separate, hydraulically actuated linkages and eccentrically mounted shafts for each frame will be both relatively expensive to construct and a ready source of malfunction.

Of equal importance, it has been found that some degree

of play is almost inherent in this type of actuating system and that, almost invariably, when the frames are moved into operative position after a temporary discontinuance of the coating operation, the pressures or spacings between the rolls and the web, which had been set before discontinuance of the operation, have changed. Hence, upon resumption of coating it is usually necessary to readjust the positions of the rollers until an acceptable coating on the web being treated is obtained. Not only does this result in lost production time, but the web and coating material used in making these adjustments are wasted.

SUMMARY

In accordance with the present invention an actuating system is provided which permits the applicator and transfer rolls to be set to their desired operating pressures or spacings. When it becomes necessary to stop the coating operation, the frames on which the rolls are mounted are pivoted rearwardly, withdrawing the rolls from the work piece.

Upon resumption of coating, force is applied directly to the transfer roll frame causing it to tilt forward and move the transfer roller evenly toward the applicator roll. An adjustable, lost motion stop engages the transfer roll frame when the transfer roll has moved to the spacing or pressure value with the applicator roll which had been maintained before interruption of the coating operation. When the transfer roller has been moved to its desired position with respect to the applicator roll, continued application of force to the transfer roll frame is transmitted through the stop member to the applicator roll frame causing this frame to tilt forward about its pivot and carry the applicator roll towards the work piece. A second, adjustable, lost motion stop mounted on the base frame then engages the applicator roll frame when that frame has pivoted to a position such that the applicator roll is brought into its desired position with respect to the workpiece.

The two stops and the force applied to the transfer roll frame then serve to maintain the frames, and the rolls carried thereby, in their operative positions until it is again desired to discontinue the coating operation at which time the force applied to the transfer roll frame is relaxed and the frames allowed to pivot rearwardly and withdraw the rolls from their operative positions.

It will be seen that with the present apparatus the need for precision finished trackways is eliminated.

It will also be seen that by pivoting the frames rather than sliding them, the frames are always moved evenly into and out of position and the danger of the rolls becoming skewed is obviated.

It will also be seen that force need only be applied to the transfer roll frame since that force is also transmitted through the stop members to the applicator roll frame. Thus, the need for separate actuating systems for each roll is eliminated.

Additionally, through the use of pivoted frames and adjustable stops not only are the rather complicated, dual actuating systems replaced, but the rolls are precisely placed in their desired positions with respect to each other and the workpiece.

Further, by use of the lost motion stops, the rolls are moved serially into their respective positions by a single continuous application of force. Thus, the transfer roller is first moved into its desired position with respect to the applicator roll, causing coating to be transferred thereto, then the entire assembly of rolls is moved as a unit until the applicator roll is in its desired position and coating the workpiece.

These and other objects and advantages will become more readily apparent from the following description.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a vertical cross-sectional view through a printing or coating station embodying principles of the present invention; and

FIGURE 2 is a rear elevational view thereof.

DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to FIGURE 1, it will be seen that the coating or printing station comprises a base frame **1**, an applicator roll frame **2**, and a transfer roll frame **3**. Both sides of the printing or coating station are identical and in the following description one side only will be described; it being understood that the opposite side thereof is the same as that described.

Frame **3** carries a pickup roll **4** and a transfer roll **5**, rotatably mounted thereon, with the lower portion of the pickup **4** rotating in a pan or tray **6**, which will contain a supply of the coating material.

Applicator roll frame **2** is of substantially reversed L-shape, as seen in FIGURE 1, and carries the applicator roll **7** rotatably mounted between its upright legs **8**. Positioned adjacent the applicator roll **7** is a backup roller **9**, which carries a web **10** of the material to be treated past the printing or coating station. Frame **3** overlies frame **2** and is pivotally attached thereto, as at **11**, and frame **2**, in turn, is carried by the base frame **1** and is pivotally attached thereto, as at **12**, with the axes of all rollers and pivot points parallel to each other.

Adjacent the rear end of frame **1** a cylinder **13** is pivotally attached, as at **15**, and slideably receives a piston carrying a piston rod **16**, which in turn, is pivotally attached at its outer end to frame **3** by means of a pivot shaft **17** extending between opposite sides of the frame.

As seen in FIGURES 1 and 2, a clevis member **18** is fixed to the rear end of frame **2**, by bolts **19** or the like, and has upstanding, spaced, parallel legs **20**. An adjustable, lost motion stop **21** is positioned between the upstanding legs **20** of the clevis and is pivotally attached thereto, as at **22**. The stop **21** comprises a substantially horizontally extending leg **23** and a substantially vertically extending leg **24**, with the leg **23** overlying a rearwardly projecting shoulder **25** of the frame **3**. A threaded adjusting member **26** extends through the leg **24** of stop **21** and has a handle **27** for moving the adjusting screw **26** inwardly and outwardly of the leg **24**. A lock nut **28** is also provided for locking the adjusting member **26** in position.

Frame **2** is also provided with a rearwardly extending shoulder **29**, and, attached to the rear end of base frame **1** is a second clevis member **30**, having upstanding legs **31**. An adjustable lost motion stop member **21**, identical to that described above, is also provided, pivotally mounted between the upstanding legs **31** of clevis **30**.

In its inoperative position, frame **2** wil be resting on frame **1** and frame **3** will be resting on frame **2** with the lower surface of arm **23** spaced from the upper surface of shoulder **25** and the upper surface of shoulder **29** spaced from the lower surface of the leg **23** adjacent thereto. In this position, roll **5** will be spaced from roll **7**, and roll **7** will be spaced from roll **9** and the web **10** of material carried thereby. The spacing between shoulders **25** and **29** and the respective legs **23** of adjacent stops **21** will be determined by the extent to which the adjusting members are threaded through the legs **24** of the stop members.

With the components of the coater in their inoperative positions, as described above, when it is desired to resume the coating operation, cylinder **13** is pressurized, causing the piston **16** to extend outwardly thereof. This will cause the frame **3** to pivot about point **11** until the upper surface of the shoulder **25** engages the lower surface of adjacent leg **23**. At this point the axes of rolls **5** and **7** will be in their desired positions with respect to each other.

Continued extension of the piston **16** from the cylinder

13 will cause the pivoting force applied to the frame **3** to be transmitted by the shoulder **25** and stop member **21** to the frame **2**; causing this frame to pivot about point **12**. Frame **2** will then pivot about point **12** until the upper surface of its shoulder **29** contacts the lower surface of the adjacent overlying leg **23**. At this point, the axes of rollers **7** and **9** will be at their desired spacing and coating or printing will be applied to the web **10**.

The rollers **7** and **5** will remain in their operative positions as long as sufficient pressure is maintained in the cylinder **13**. When it is desired to temporarily discontinue the coating operation, the pressure in cylinder **13** is relaxed and the frames **2** and **3**, and the rolls **7** and **5**, respectively, are allowed to move rearawrdly to their inoperative positions. When it is again desired to commence coating, the cylinder **13** is once again pressurized and the rollers **7** and **5** move, as described above, into their former positions.

It will be seen that because the movement of frames **2** and **3** is a pivotal motion, the rolls **7** and **5** mounted thereon will always move with their axes parallel to the original positions thereof and skewing of the rolls is obviated. Additionally, since the stops **21**, locked in position by the lock nuts **28**, provide a positive stop between adjacent frames, the rolls, when tilted forward, will always move into exactly the same position they occupied prior to interruption of the coating operation.

Thus, not only does the present invention eliminate the complicated dual actuating system of the prior art, but a system is provided which insures that the rolls will be positively moved into and out of their operative positions.

While a preferred embodiment of the invention has been described for purposes of illustration, it will be apparent that modifications thereof will occur to those skilled in the art within the scope of the appended claims.

I claim:

1. A coating or printing station comprising:

(a) a base frame,

(b) a substantially L-shaped frame overlying said base frame and pivotally attached to said base frame adjacent the intersection of the legs of said L-shaped frame,

(c) an applicator roller rotatably mounted between the upstanding legs of said L-shaped frame,

(d) a transfer roller frame overlying said L-shaped frame and pivotally attached thereto,

(e) a transfer roller rotatably mounted on said transfer roller frame,

(f) the axes of said rollers and the pivotal connections being substantially parallel,

(g) a first clevis member having a pair of spaced upstanding legs mounted on said base frame,

(h) a first L-shaped member pivotally mounted between said legs of said first clevis with one leg of said first L-shaped member extending substantially horizontally in spaced relation to a rearwardly projecting shoulder on said L-shaped frame and the other leg thereof extending substantially vertically in spaced relation to said base frame,

(i) an adjusting screw threaded through said vertically extending legs of said first L-shaped member and bearing at one end against said base frame,

(j) a second clevis member having a pair of spaced upstanding legs mounted on said L-shaped frame,

(k) a second L-shaped member pivotally mounted between said legs of said second clevis with one leg of said second L-shaped member extending substantially horizontally in spaced relation to a rearwardly projecting shoulder on said transfer roller frame and the other leg thereof extending substantially vertically in spaced relation to said L-shaped frame,

(l) an adjusting screw threaded through said vertically extending leg of said first L-shaped member and bearing at one end against said L-shaped frame,

(m) a cylinder pivotally attached at one end to said base frame, and

(n) a piston slideably received in said cylinder and having a piston rod pivotally attached to said transfer roll frame.

2. A coater or printing station comprising:
(a) a first pivotally mounted frame having a roll rotatably mounted thereon,
(b) a second pivotally mounted frame having a roll rotatably mounted thereon,
(c) the axes of said rolls and the pivotal connections of said frames extending in parallel relationship to each other,
(d) a first lost motion stop mounted on said first frame and comprising:
(i) a clevis having a pair of spaced legs,
(ii) a substantially L-shaped member pivotally mounted between said clevis legs with one leg of said L-shaped member overlying a portion of said first frame and the other leg of said L-

shaped member overlying a portion of said second frame, and
(e) means for applying a pivoting force to said second frame.

3. The apparatus of claim 2 further comprising:
(a) means for varying the spacing between the legs of L-shaped member and adjacent portions of said frames.

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WALTER A. SCHEEL, *Primary Examiner.*

ROBERT I. SMITH, *Assistant Examiner.*

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,397,675 August 20, 1968

John De Ligt

It is certified that error appears in the above identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, line 42, "In this type of operation it is necessary to maintain a" should read -- sense to cover printing as well as the application of a --. Column 2, line 32, after "frame" insert a semicolon; line 43, after "operation" insert a semicolon; line 67, after "then" insert a comma. Column 3, line 39, after "21" insert a comma; line 55, "wil" should read -- will --. Column 4, line 14, "rearawrdly" should read -- rearwardly --; line 72, "first" should read -- second --.

Signed and sealed this 3rd day of March 1970.

(SEAL)

Attest:

Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents

22

March 18, 1969 R. K. NORTON 3,433,155

MECHANISM FOR APPLYING A COATING TO A PLATE

Filed Sept. 13, 1965 Sheet 1 of 2

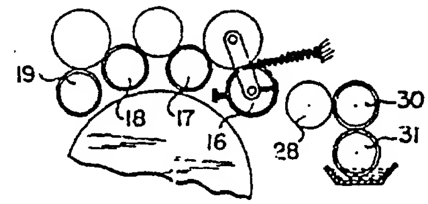

FIG.2

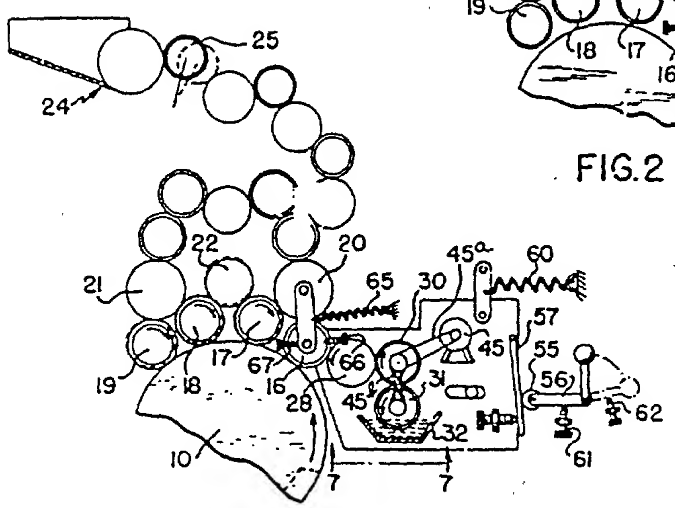

FIG.1

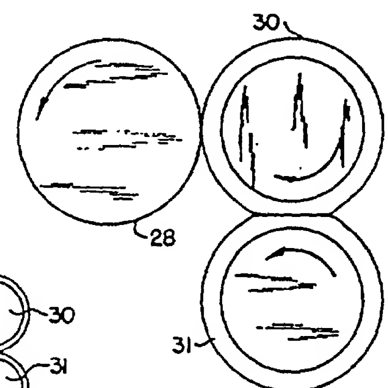

FIG.4

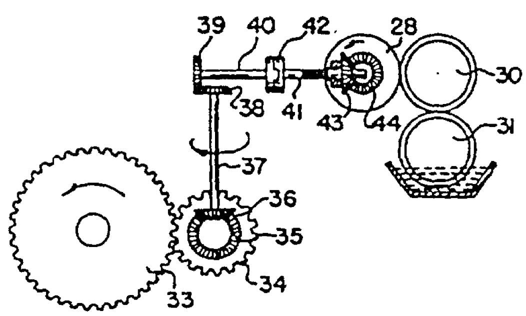

FIG.3

INVENTOR.

ROBERT K. NORTON

BY

Hoffmann and Yount

ATTORNEYS

MECHANISM FOR APPLYING A COATING TO A PLATE

Filed Sept. 13, 1965 Sheet 2 of 2

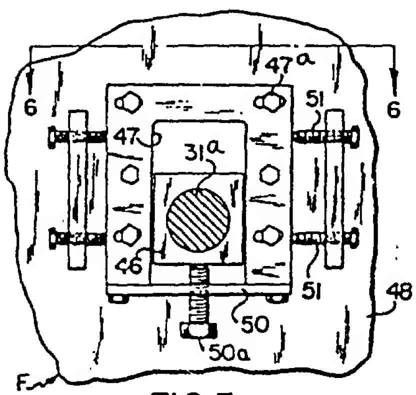

FIG.5

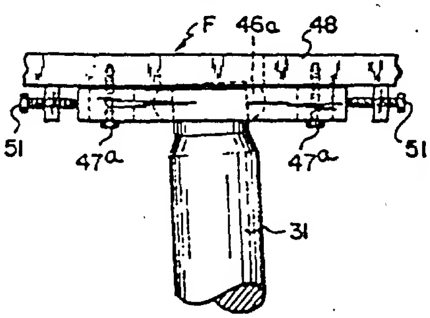

FIG.6

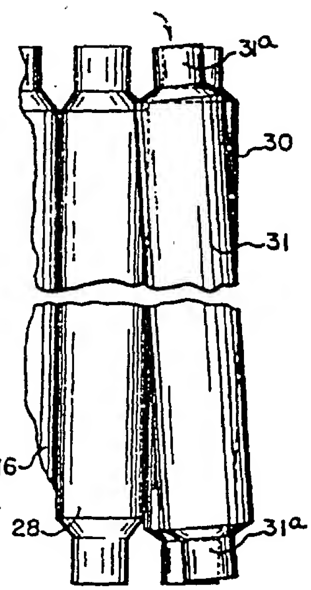

FIG.7

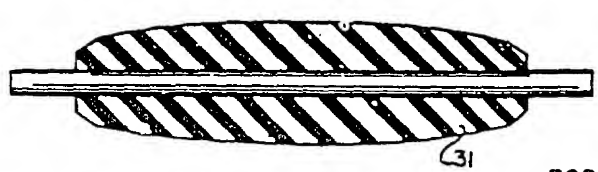

FIG.8

INVENTOR.
ROBERT K. NORTON
BY
Hoffmann and Grant
ATTORNEYS

United States Patent Office

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3,433,155

MECHANISM FOR APPLYING A COATING TO A PLATE

Robert K. Norton, Twinsburg, Ohio, assignor to Harris-Intertype Corporation, Cleveland, Ohio, a corporation of Ohio

Filed Sept. 13, 1965, Ser. No. 486,680
U.S. Cl. 101—148 8 Claims
Int. Cl. B41l 23/04, 25/02; B41f 31/14

ABSTRACT OF THE DISCLOSURE

A dampening mechanism for applying a dampening fluid to the surface of a rotating printing plate of a printing press is disclosed. The dampening mechanism comprises a form roll driven by the printing plate, a hard surface, hydrophilic roll for transferring dampening fluid to the form roll, a resilient metering roll running in pressure engagement with the hydrophilic roll for transferring the dampening fluid to the hydrophilic roll and a resilient pan roll for transferring dampening fluid from a supply to the metering roll. The hard surface, hydrophilic roll is positively rotated to have the same surface speed as the rotating printing plate and the resilient metering roll is driven at a speed which is adjustable to adjust the relative surface speeds between the hard surface, hydrophilic roll and the resilient metering roll to control the amount of dampening fluid delivered to the hydrophilic roll.

The present invention relates to a printing press or other apparatus in which a rotating applicator such as a form roll applies a fluid material, e.g., ink, dampening fluid, or both, to the surface of a printing plate or the like.

An important object of the present invention is to provide a new and improved lithographic printing press having a dampening mechanism in which the flow of dampening fluid is controlled by varying the relative surface speed of cooperating rolls in the dampening mechanism and in which the dampening mechanism includes a positively driven roll which runs in engagement with a form roll, the driven roll being driven at the surface speed of the plate to minimize the effect of scumming on the plate.

Another object of the present invention is to provide a new and improved lithographic printing press wherein the printing plate has dampening fluid applied thereto by a form roll frictionally driven from the plate with dampening fluid being supplied to the form roll from a positively driven hard surface transfer roll whose surface speed is the same as the surface speed of the plate cylinder and in which the dampening fluid on the hard surface transfer roll is controlled by varying the speed of a resilient surface running in pressure engagement with the hard surface transfer roll.

Another object of the present invention is to provide a new and improved lithographic printing press in which dampening fluid being fed to the printing press is first metered by a roll running in pressure relationship with a variable speed roll having a resilient surface with the amount of fluid being transferred by the dampening mechanism being controlled by varying the speed of the variable speed roll to vary the surface speed between the variable speed roll and a positively driven hard surface hydrophilic roll rotating at a predetermined surface speed, preferably at the surface speed of the plate.

Still another object of the present invention is to provide a new and improved lithographic printing press in which a dampening mechanism for feeding dampening fluid to the printing press has the dampening fluid metered and smoothed out by a resilient surface roll which operates as a pan roll and delivers dampening fluid to a cooperating roll having a resilient surface with the surface speed of the cooperating roll and the pan roll being the same but variable to vary the amount of dampening fluid transferred to a hard surface roll running in pressure engagement with the cooperating roll and having a predetermined surface speed.

Yet another object of the persent invention is to provide a new and improved printing press in which a dampening fluid is transferred by a plurality of rolls from a supply therefor to a printing plate and wherein the distribution and amount of dampening fluid is controlled by varying the speed of a roll having a resilient surface to change its surface speed relatively to a hard surface roll with which it has a pressure engagement.

The present invention also contemplates the provision of a new and improved apparatus embodying at least three rolls for feeding fluid material to a rotating applicator in which apparatus a first resilient surface roll controls the transfer of fluid material to a second resilient surface roll which runs in pressure relationship therewith with the surface speed of the resilient surface rolls being the same but variable relative to the speed of a hard surface transfer roll which receives the material from the variable speed transfer roll.

A still further object of the present invention is to provide a new and improved apparatus for applying a coating of fluid material to a moving surface in which a rotating applicator roll for applying the coating is rotated at a surface speed of the moving surface by frictional engagement of the moving surface and by the frictional engagement of roll means running in contact with the periphery of the applicator roll, and in which fluid material is supplied to the applicator roll from a supply therefor by a plurality of rolls including one running at a surface speed different from the surface speed of the moving surface, the plurality of rolls being arranged and driven in a manner such that there is little or no tendency of the applicator roll to slow when not engaged with the moving surface due to the drag of the roll which runs at a different surface speed.

Further objects and advantages of the present invention will be apparent from the following detailed description thereof made with reference to the accompanying drawings forming a part of the present specification and in which:

FIG. 1 is a diagrammatic view showing a portion of a printing press embodying the present invention;

FIG. 2 is a view which corresponds to a portion of FIG. 1 showing certain parts thereof in different positions;

FIG. 3 is a view, somewhat diagrammatic, of a drive for one of the dampening rolls of the apparatus shown in FIG. 1;

FIG. 4 is an enlarged view showing the relationship of three of the dampening rolls of the apparatus shown in FIG. 1;

FIG. 5 is a fragmentary view showing a bearing mounting for one of the rolls of the apparatus shown in FIG. 1;

FIG. 6 is a view taken from approximately line 6—6 of FIG. 5 looking in the direction of the arrows;

FIG. 7 is a view with certain parts omitted looking approximately from line 7—7 of FIG. 1 in the direction of the arrows; and

FIG. 8 is an elevational view of two of the rolls of the apparatus of FIG. 1 with one of the rolls having a modified structure.

The present invention is susceptible for use in various machines where it is desirable to apply a coating of a fluid material onto a moving surface with an applicator roll or other type of rotating applicator but it is particu-

larly useful to apply dampening fluid to the surface of a printing press plate cylinder.

In a lithographic offset printing press, ink and dampening fluid are applied to the printing plate and in the illustrated press, ink is fed to the printing plate through an inking mechanism which includes form rolls 16, 17, 18, 19 which run in engagement with the surface of the printing plate. A vibrating roll 20 is disposed between the form rolls 16, 17 and runs in engagement therewith while a similar vibrator roll 21 engages and runs in contact with form rolls 18, 19. A vibrator roll 22 also engages form rolls 17, 18. The vibrating rolls 20, 21, 22 are conventional vibrator rolls having a hard smooth ink receptive metal surface while the form rolls 16, 17, 18 and 19 have conventional resilient surfaces. The ink is fed to the vibrator rolls 20, 21 from an ink fountain 24 by a duct roll 25 and a plurality of ink transfer rolls shown in the drawing. The train of ink rolls shown for supplying ink to the form rolls is that of a conventional inker and therefore will not be described in detail.

In accordance with the preferred and illustrated embodiment, dampening fluid is applied to the plate on the cylinder 10 by a dampening mechanism which feeds the dampening fluid through the first form roll 16 which is larger than the other form rolls. The dampening mechanism includes roll 28 having a hard hydrophilic, smoothly finished surface, preferably chrome, which rotates in pressure relationship with the first form roll 16, a resilient surface variable speed roll 30 which runs in pressure relationship with the hard chrome roller 28 and a cooperating metering roll 31 having a resilient surface and rotating in a pan 32 containing the dampening fluid. The metering pan roll 31 picks up dampening fluid from the pan 32, transfers it to the roll 30, which in turn transfers the dampening fluid to the chrome transfer roll 28 running in engagement with the first form roll 16 to feed the dampening fluid to the form roll and from the form roll 16 to the plate. To control the amount of dampening fluid being transferred between the pan 32 and the form roll, the roll 30 is driven at a speed which is variable to vary the relative surface speeds of the metering roll 30 and the chrome transfer roll 28. The variable speed metering roll 30 and the metering pan roll 31 are driven to rotate at the same surface speed. Consequently, the metering pan roll 31 is rotated at the same surface as the metering roll 30 but this surface speed is variable to control the amount of fluid transferred between the roll 30 and the roll 28 which rotates at a fixed surface speed for a given press speed. The rolls 28, 30 and 31 each preferably rotate in an opposite direction to the roll or rolls which it engages, but the rolls 30, 31 may be driven so that the roll 30 rotates in the same direction as the chrome roll 28.

In the preferred mechanism the chrome transfer roll 28 is positively driven from the plate cylinder and is rotated at the same surface speed as the plate cylinder. The vibrator roll 20 is also positively driven from the press at the same surface speed as the plate cylinder in a conventional manner and the form roll 16 is frictionally driven from the vibrator roll 20, the chrome transfer roll 28 and the plate cylinder. In the illustrated arrangement, the chrome transfer roll 28 is shown as being driven from a gear 33 which is on the plate cylinder and rotates therewith. The gear 33 drives a gear 34 which drives a shaft 37 through bevel gears 35, 36. The shaft 37 is connected by bevel gears 38, 39 to drive a shaft 40 which in turn drives a shaft 41 through a clutch 42. The shaft 41 has a bevel gear 43 thereon which meshes with a bevel gear 44 on the shaft of the transfer roll 28. The spline connection of the gear 43 allows the transfer roll 28 to be moved into and out of engagement with the form roll 16 while maintaining a drive thereto. The chrome roll is preferably driven at the surface speed of the plate cylinder to frictionally drive the form roll 16 at this speed to thereby prevent any drag on the form roll which may occur when a roll which runs in engagement therewith rotates at a slower surface speed. In mechanisms where the dampening roll running in engagement with the form roll is driven at a slower speed, there is a frictional drag on the form roll which tends to slow the form roll as the gap which is present in conventional plate cylinders passes the form roll. I have found that this may cause a scumming or smudging on the lead edge portion of the printing plate. By providing a dampening mechanism where the roll of the dampening mechanism in engagement with the form roll is positively driven at the surface speed of the plate cylinder, this tendency of the slower speed roll 30 to effectively brake the form roll is overcome or minimized.

The variable speed metering roll 30 is driven by a variable speed motor 45 through a positive drive shown as a chain drive 45*a*. A chain drive 45*b* may also be used to drive the metering roll 31 from the roll 30 to rotate them in a 1 to 1 relationship so that they have the same surface speeds.

In the described mechanism, the chrome transfer roll 28 and the form roll 16 are of the same length but the metering roll 30 is longer than the chrome transfer roll 28 so as to extend beyond the opposite ends thereof.

The pressure relationship between the metering pan roll 31 and the metering roll 30 is adjustable to smoothly meter the flow of dampening fluid between the nip of the rolls to provide an evenly distributed thin film of dampening fluid on the roll 30. The pan metering roll 31 preferably has shaft portions extending from the opposite ends thereof to be supported in bearing blocks which may be moved toward and away from the metering roll 30 to adjust the pressure relationship between the rolls 30, 31. Bearing blocks of this type are conventional and well known in the art and a simplified bearing support for the roll 31 is shown in FIG. 5. As shown in FIG. 5, the shaft portion 31*a* extending from one end of the roll 31 is received in a self-centering bearing 46*a* in a bearing block 46 which is supported in an inverted U-shaped recess in a guide block 47 mounted on a support member 48 of the frame F of the press. The open end of the U-shaped recess is closed by a plate 50 and a pressure adjusting bolt 50*a* is threaded through the plate 50 to engage the bearing block 46 and is adjustable to move the roll 31 upwardly into an adjustable pressure relationship with the roll 30. Preferably, the mounting block 47 is mounted onto the support member 48 by screws 47*a* which are received in elongated slots in the mounting block to allow the mounting block 47 and the bearing block 48 to be shifted laterally, i.e. horizontally, to adjust the axis of the roll 31 to provide a skewed relationship relative to the roll 30. The mounting block 47 is shown as being adjustable laterally by the operation of a plurality of adjusting screws 51. Since the metering pan roll 31 is supported at both ends by the same type of support the metering roll 31 can be moved to a skewed position relative to the roll 30 as is best shown in FIG. 7. The bearings 46*a* at each end of the roll 31 pivot in the respective block 46 to accommodate the skewing of the roll.

A skewed position for the metering roll 31 is advantageous to obtain a thin evenly distributed film on the roll 31. When a pressure relationship is established by applying forces to the shaft portions at the opposite ends of the metering roll 31, the roll tends to bow outwardly in the center portion of the roll and to allow more dampening fluid to pass the center portion of the roll than the ends of the roll. By skewing the axis of the rolls 30, 31, an even pressure relationship along the area of contact can be obtained since bowing the roll is required to provide an even contact when the rolls are skewed.

The roll 31 may be a crowned roller as indicated in FIG. 8. In FIG. 8, the roll 31 tapers in an arcuate manner from the central portion thereof to the ends so that when the pressure relationship is established between the rolls 30, 31, the rolls engage over an area of substantially constant width. Preferably, the area of contact is a narrow strip extending the length of the rolls 30, 31.

The exact extent of the crown may be determined empirically and varies in accordance with the length of the roll and its strength and in accordance with the materials involved. A crowned roll may be used in combination with skewing or in lieu of skewing.

The resilient roll 30 and the chrome roll 28 also run in pressure relationship and this relationship may be adjustable by the use of movable bearing blocks similar to those on the roll 31.

As indicated by dotted lines in FIG. 1, the form rolls 17, 18 and 19 are supported for movement to an inker off position in a conventional manner while the form roll 16 is moved from its position against the plate by operation of the dampening mechanism. The dampening mechanism as a whole is supported for movement toward and away from the cylinder to move the chome roll 28 into and out of engagement with the form roll 16. A roller 55 on a pivoted actuating arm 56 may be swung to the position shown in FIG. 1 to move the dampening mechanism from the position shown in FIG. 2 to establish the pressure relationship between the relative positions of the chrome roll 28 and the form roll 16 shown in FIG. 1. The roller engages an adjustable plate 57 on the dampening mechanism to move the latter against the action of a spring 60. Stops 61, 62 may be provided to limit the movement of the arm between the inker on and inker off position. In its "on" position, the pivoted arm 56 is in a dead center or locking position slightly over dead center. Adjustment of the plate 57 determines the "on" position of the dampener and the pressure relationship between the rolls 16, 28.

When the vibrating roll 28 is to be moved out of engagement with the form roll 16, the arm 56 is rotated to allow the dampening mechanism to be moved away from the impression cylinder by the spring 60.

In the illustrated embodiment, the form roll 16 is mounted for limited movement about the axis of the vibrator roll 20. When the dampening mechanism is moved to clear the chrome roll 28 from the form roll 16, the form roll is moved by a spring 65 against a stop 66 to move the form roll out of engagement with the plate cylinder. When the dampening mechanism is again moved to its operative position, the chrome roll 28 engages the form roll 16 and moves it against the spring 65 to a position against the plate cylinder and against a stop 67 which limits the pressure that the form roll may apply to the plate cylinder and provides a resisting force to the chrome roll 28 to establish a pressure relationship between the chorme roll 28 and the form roll 16.

It can be seen that with the described construction, the dampening mechanism can be operated when the mechanism is in its retracted position to form films on the rolls of the dampening mechanism and to cause the chrome roll 28 to be operating at press speed when it is moved into engagement with the form roll. It will be noted that the dampening mechanism can be moved to engage the form roll 16 with the chrome roll 28 rotating at the surface speed of the press, prior to the form roll engaging the plate. This enables the form roll 16 and the chrome roll 28 to be rotating at their proper speeds when the form roll 16 engages the plate. By positively driving the chrome roll 28, the chrome roll 28 will be driven at its proper speed when it is moved into engagement with the form roll 16 and the form roll 16 will be driven from both the vibrating roll 20 and the chrome roll 28. This will also keep the form roll 16 rotating at a surface speed corresponding to the surface speed of the plate cylinder 10 when the gaps in the cylinder 10 are moving past the form roll 16.

It will be understood by those skilled in the art that the term hard surface roll as used in this specification includes a roll having an unyielding surface such as is commonly present on vibrator rolls and chrome hydrophilic rolls and is used to distinguish from other rolls commonly used in presses and which have a yieldable, resilient surface such as neoprene or rubber.

While the preferred embodiment and other embodiments of the present invention have been disclosed and described in detail, it is hereby my intention to cover all modifications, adaptations and arrangement of parts which fall within the ability of those skilled in the art and within the spirit of the appended claims.

Having described my invention, I claim:

1. In a lithographic printing press having a printing plate mounted on a rotatable plate cylinder with a gap therein, a dampening mechanism for supplying dampening fluid to an applicator roll running in engagement with a printing plate on the plate cylinder, a supply comprising a reservoir of dampening fluid for said plate, a hydrophilic roll running in rolling contact with said applicator roll, first drive means independent of the surface of said hydrophilic roll for positively driving said hydrophilic roll at the surface speed of said printing plate, means for delivering dampening fluid to said hydrophilic roll and forming an even film thereon comprising a resilient surface roll, first support means supporting said resilient surface roll to roll in engagement with said hydrophilic roll and for adjustment toward and away from said hydrophilic roll, second drive means apart from the surface of said resilient surface roll for driving said resilient surface roll at a surface speed which is adjustable independently of adjusting the speed of said hydrophilic roll to adjust the relative surface speeds of said resilient surface roll and said hydrophilic roll to control the amount of dampening fluid delivered to said hydrophilic roll, and means for delivering dampening fluid to said resilient surface roll and for metering the fluid delivered to form a thin evenly distributed film on said resilient surface roll comprising a pan roll which dips into said reservoir of dampening fluid, and second support means rotatably supporting said pan roll in continuous engagement with said resilient surface roll including means for adjusting the axis of said pan roll toward and away from said resilient surface roll separately from the adjustment of said resilient roll toward and away from said hydrophilic roll.

2. In a lithographic printing press having a printing plate mounted on a rotatable plate cylinder with a gap therein, a dampening mechanism for supplying dampening fluid to an applicator roll in running engagement with the printing plate on the rotating plate cylinder, a supply of dampening fluid, a hydrophilic roll running in rolling contact with said applicator roll, said hydrophilic roll having a hard unyieldable hydrophilic surface, drive means independent of the surface of said hydrophilic roll for positively driving said hydrophilic roll at the surface speed of said printing plate, means for delivering dampening fluid to said hydrophilic roll and forming an even film thereon comprising a resilient surface roll, means supporting said resilient surface roll to run in engagement with said hydrophilic roll with the axes of said hydrophilic roll and said resilient surface roll being spaced generally horizontally from each other, said means supporting said resilient surface roll comprising adjustable means for adjusting the distance between the axes of said hydrophilic roll and said resilient surface roll to adjust the pressure relationship therebetween, a metering pan roll disposed generally vertically below said resilient surface roll, means supporting said pan roll for rotation and running engagement with said resilient surface roll including means for adjusting the axis of said pan roll vertically to adjust the pressure relationship between said pan roll and said resilient surface roll, a pan providing a reservoir of fluid in which the lower portion of said pan roll runs, and means for driving said pan roll and said resilient surface roll at the same speed which is slower than the surface speed of the plate cylinder.

3. In a lithographic printing press, a dampening mechanism as defined in claim 2 wherein said supporting means for said pan roll comprises adjustable bearing supports

for adjusting the axis of said support roll horizontally to skew the roll with respect to the resilient surface roll and vertically to urge the skewed pan roll into uniform pressure engagement with said resilient surface roll for substantially the entire length of the rolls.

4. In a lithographic printing press as defined in claim 2 wherein said pan roll comprises a roll having a diameter which progressively decreases proceeding from the center toward each end to compensate for deflection of said shaft means on the establishment of a pressure relationship between pan roll and said resilient surface roll.

5. In a lithographic printing press, a dampening system for supplying fluid to a form roll running in engagement with the plate cylinder comprising a pan containing a reservoir of dampening fluid, a pan roll having its lower portion running in the reservoir of dampening fluid, a resilient surface roll disposed above the pan roll and running in engagement therewith, said pan roll having shaft means projecting outwardly from each end thereof, bearing means supporting said shaft means including means for adjusting said shaft means horizontally to skew said pan roll relative to said resilient surface roll and means for adjusting said shaft means vertically to adjust the pressure relationship between said resilient surface roll and said pan roll, and a third roll running in liquid transfer relationship with said resilient surface roll with the axis of said third roll being disposed generally horizontally from the axis of said resilient surface roll, drive means separate from the surface of said third roll for driving said third roll at a fixed speed, motor means connected to one of said pan and resilient rolls separately from the surface thereof to drive said pan and resilient surface rolls at the same surface speed and at a speed slower than the speed of said third roll.

6. In a lithographic printing press as defined in claim 5 wherein the press includes means supporting said rolls to move said third roll into and out of engagement with said form roll while running in engagement with each other, said drive means for driving said third roll and said motor means being operable to drive the corresponding rolls when said third roll is clear of said form roll and when in engagement with the latter.

7. In a lithographic printing press, a dampening system for supplying fluid to form a roll running in engagement with the plate cylinder comprising a pan containing a reservoir of dampening fluid, a pan roll having its lower portion running in the reservoir of dampening fluid, a resilient surface roll disposed above the pan roll and running in engagement therewith, said pan roll having shaft means projecting outwardly from each end thereof, bearing means supporting said shaft means including means for adjusting said shaft means vertically to adjust the pressure relationship between said resilient surface roll and said pan roll, and a third roll running in liquid transfer relationship with said resilient surface roll with the axis of said third roll being disposed generally horizontally from the axis of said resilient surface roll, drive means separate from the surface of said third roll for driving said third roll at a fixed speed, motor means connected to one of said pan and resilient rolls separately from the surface thereof to drive said pan and resilient surface rolls at the same surface speed and at a speed slower than the speed of said third roll, said pan roll comprising a roll having a diameter which progressively decreases proceeding from the center toward each end to compensate for deflection of said shaft means on the establishment of a pressure relationship between pan roll and said resilient surface roll.

8. In a lithographic printing press, a dampening system for supplying fluid to a form roll running in engagement with the plate cylinder comprising a pan containing a reservoir of dampening fluid, a pan roll having its lower portion running in the reservoir of dampening fluid, a resilient surface roll disposed above the pan roll and running in engagement therewith, said pan roll having shaft means projecting outwardly from each end thereof, bearing means supporting said shaft means including means for adjusting said shaft means horizontally to skew said pan roll relative to said resilient surface roll and means for adjusting said shaft means vertically to adjust the pressure relationship between said resilient surface roll and said pan roll, and motor means connected to one of said pan and resilient rolls separately from the surface thereof to drive said pan and resilient surface rolls at the same surface speed and at a speed slower than the surface speed of said form roll.

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EDGAR S. BURR, *Primary Examiner.*

U.S. Cl. X.R.

101—349; 118—262; 222—30; 235—94; 346—98

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United States Patent [19]
Kumpf

[11] 3,768,438
[45] Oct. 30, 1973

[54] MACHINE FOR COATING SHEETS OF PAPER AND THE LIKE WITH LIQUID COATING MATERIALS

[76] Inventor: **Wilhelm Kumpf**, No. 38, Am Anger, Erlangen, Germany

[22] Filed: **Sept. 1, 1971**

[21] Appl. No.: **176,856**

[30] **Foreign Application Priority Data**
May 19, 1971 Germany .... P 21 24 825.9

[52] **U.S. Cl.** **118/262**
[51] **Int. Cl.** **B05c 1/06**
[58] **Field of Search** .... 118/211, 212, 262, 118/248, 249, 239; 117/111 H, 111

[56] **References Cited**

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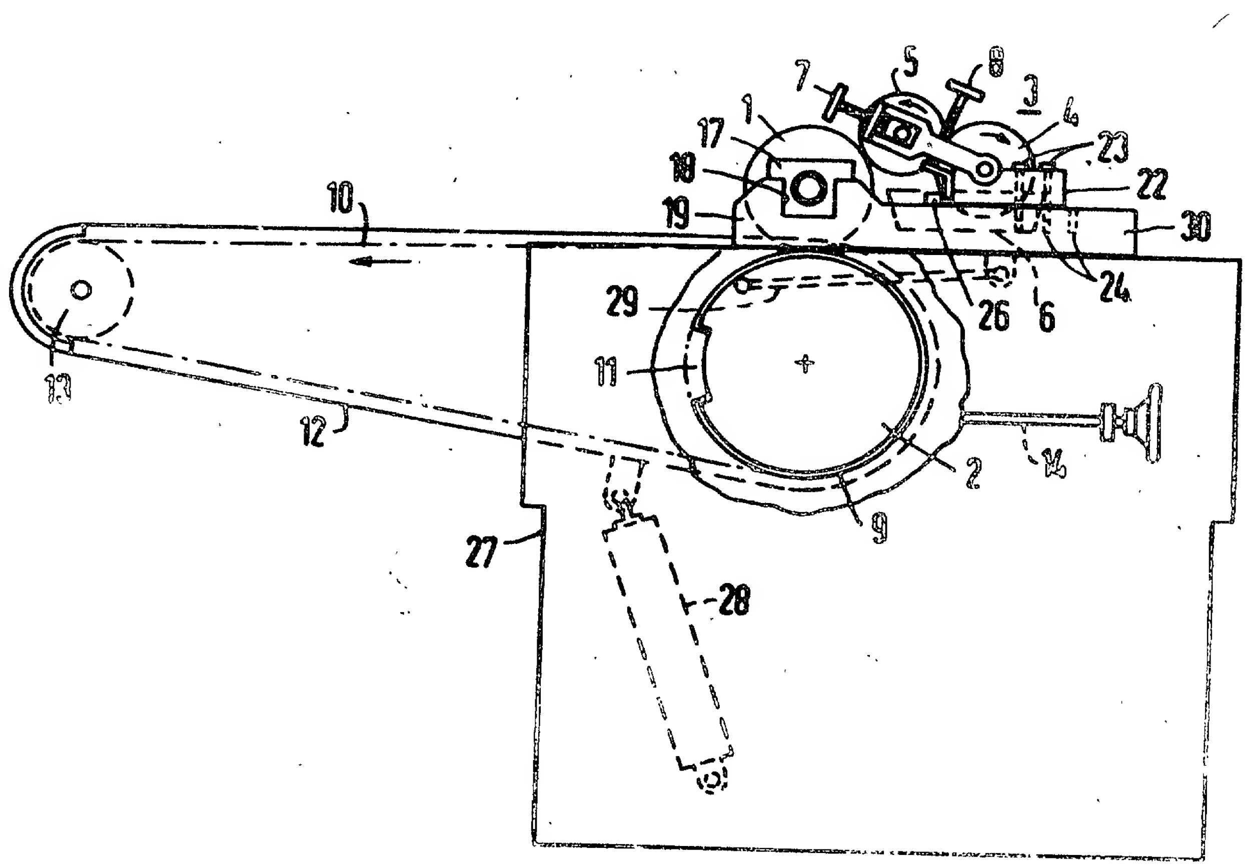
Primary Examiner—Henry S. Jaudon
Attorney—Jacobs & Jacobs

[57] **ABSTRACT**

A machine for coating sheets of paper and the like with liquid coating materials, in which the sheets are conducted without the application of pressure between a smooth coating roller and a larger diameter format roller, preferably rotating at different peripheral speeds, for coating the entire surfaces of said sheets, a feed roller accepting the coating material from a fountain roller dipping into a supply of coating material and transferring a film of desired thickness to the coating roller. For applying the coating material to predetermined parts of the surfaces of sheets the smooth coating roller together with special chocks mounted in bearing supports is removable from the machine and replaceable by a screen roller provided with screen surfaces corresponding to the surfaces that are to be coated. The screen roller revolves at the same peripheral speed and has the same diameter as the format roller, besides being mounted in taller chocks adapted to its larger diameter, but insertable into the same bearing supports. A doctor blade cooperates with the screen roller attachable to existing fixing means. The format roller is designed to withstand the high roller pressures required for gravure printing.

6 Claims, 3 Drawing Figures



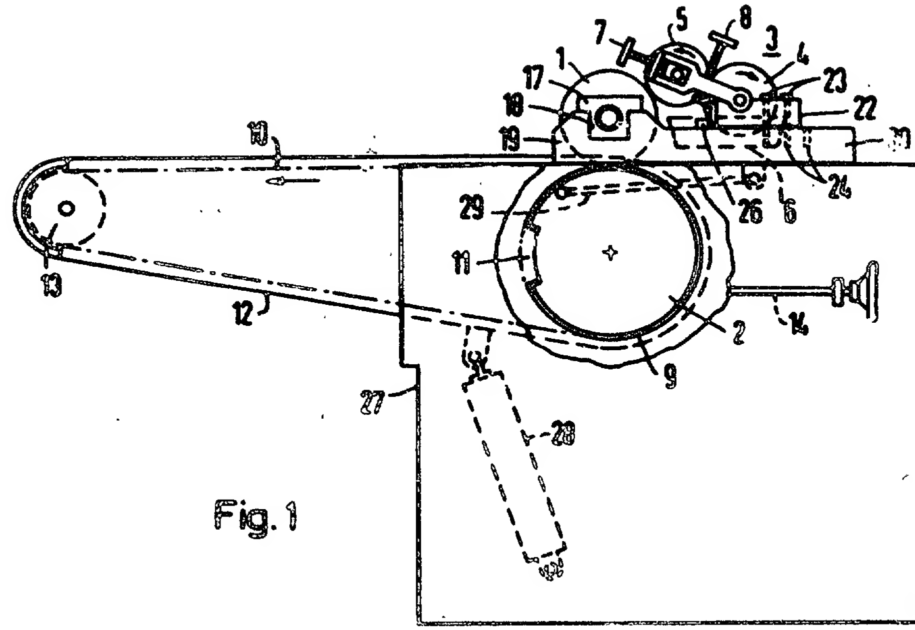

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Fig. 1

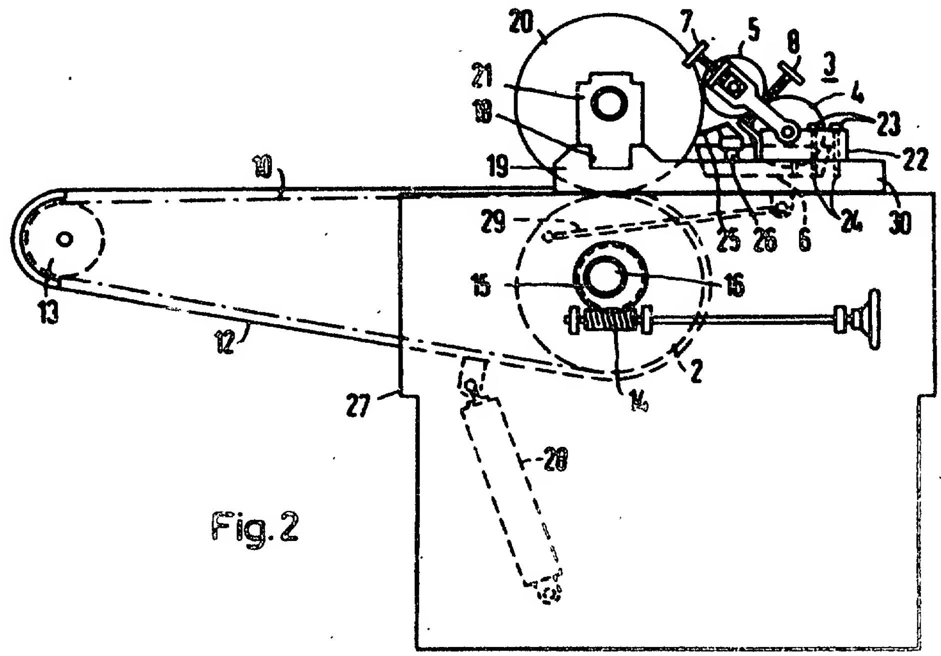
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Fig. 2

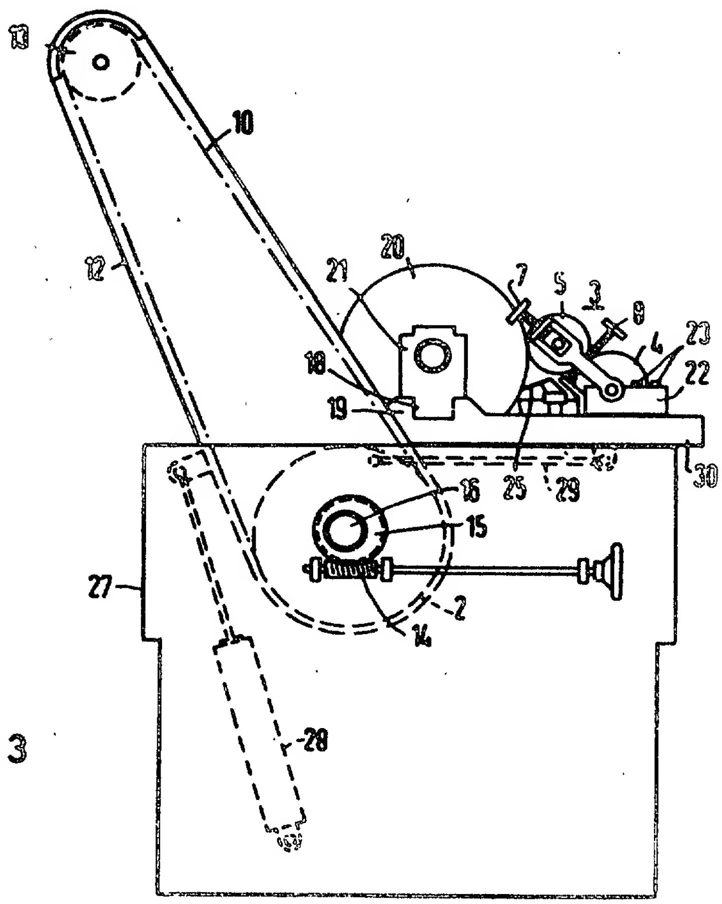

Fig. 3

MACHINE FOR COATING SHEETS OF PAPER AND THE LIKE WITH LIQUID COATING MATERIALS

BACKGROUND OF THE INVENTION

This invention relates to a machine for coating sheets of paper and the like with liquid coating materials, particularly with gloss or colored varnishes or adhesives. Coating the entire faces of sheets of paper usually presents no major difficulty. The coating material can be applied-in the same way as the ink in rotary printing presses — by a system of rubber rollers. Substantially this system comprises a fountain roller which dips into a supply of the coating material and delivers the same through an intermediate transfer or feed roller in the form of a film of the desired thickness to a third roller which functions as a coating roller The latter applies the material to the sheets which are conveyed through the gap between the coating roller and a cooperating counter-roller.

The counter-roller is analogous to a cylinder known in gravure machines as the "format cylinder." It will therefore hereinafter be described as the "format roller," because it likewise carries a rubber blanket underneath which a flat insert is placed of the same format as the sheet that is to be coated. The resultant raised backing for the sheet ensures that only the face of the sheet will be coated but that the remainder of the format roller will remain free of coating material.

However, contrary to gravure machines no pressure is exerted between the coating roller and the counter-roller, since otherwise the film of varnish or the like would be squeezed out. The two rollers are adjusted to leave a gap sufficiently wide to permit the coating material to be applied to the sheet by light contact. A gentle rubbing motion of the coating material is in fact advantageous. Consequently the coating roller and the counter-roller are driven at slightly different peripheral speeds. Analogously, no contact pressure is created between the fountain roller, the feed roller and the coating roller They are likewise placed close enough for the transferred lacquer or like film to have the desired thickness. Since none of the four rollers is required to withstand major stability stresses each may be a lightweight metal cylinder, the coating, feeding and fountain rollers being provided with polished rubber coverings. Moreover, in order to achieve a more uniform distribution of the coating material that is applied to the sheets the circumference of the rubber coating roller is also shorter than the length of the sheet or the circumference of the format roller.

Lacquering and like coating machines of the described kind for coating one complete side of sheets are known in the art. They work satisfactorily and can be produced at low cost so that their employment is economically justified although they are merely auxiliary surface finishing machines that have a low product value compared to that of printing machines.

However, frequently the need arises not only of coating one complete side of paper or like sheets with liquid materials, but also of coating only particular parts of the sheet surface, for instance in the application of coloring or gloss varnishes to paper that is to be used for packing, when certain surfaces are to be kept free of varnish to enable them to accept glue. Moreover, in order to economise in the consumption of say varnish, it is advantageous to coat only those portions of the surface that can later be seen, for instance in folding packages in which large parts of the paper surface are hidden.

In the printing art the inking of part of the surface of sheets is already done in color printing. For this purpose gravure machines are used in which the printing cylinder has a screen corresponding to the surfaces that are to be inked. An excess of ink is applied to these screens and the surplus is removed with a doctor. The ink which remains in the cells of the screen is then transferred to the sheet by the application of considerable pressure. Gravure machines of this kind are large and expensive rotary machines for the production of glossy magazines, books and the like. Their employment for partly coating sheets merely for the purpose of imparting to their usually previously printed surface a greater advertising appeal by the application of a gloss varnish or of providing certain portions with an adhesive would be entirely uneconomical. Machines for performing these latter tasks may cost only a small fraction of the investment cost of a gravure machine if they are to be economically acceptable.

It has also been proposed to solve the problem of coating part surfaces by using plate cylinders in which the surfaces that are to be coated — in the same way as the plates in relief printing — are in relief. However, difficulties arise in the distribution of the coating material, particularly at the edges of such plates.

SUMMARY OF THE INVENTION

The invention seeks to improve the first hereinabove described machine that comprises a rubber roller system for coating the entire side of sheets, the object of the invention being to modify such a machine without major expense so that it can be converted into a machine for coating only predetermined portions of the surfaces of sheets. This makes the provision of a second independent machine for such a purpose unnecessary.

For achieving this object the present invention consists in that for applying a coating material to predetermined parts of the surfaces of sheets the smooth coating roller together with a pair of special chocks mounted in bearing supports is removable from the machine and replacable by a screen roller provided with screen surfaces corresponding to the surfaces that are to be coated, the screen roller revolving at the same peripheral speed and having the same diameter as the format roller, besides being mounted in a pair of taller chocks that are adapted to its larger diameter but are nevertheless insertable into the same bearing supports, a doctor blade cooperating with the screen roller being attachable to existing fixing means and the format roller designed to withstand the high contact pressures required in gravure printing.

Since the circumference of the smooth rubber-covered coating roller for coating the entire face of the sheets must be shorter than the length of the sheets, and also than the circumference of a screen roller, in order to ensure a uniform distribution of the coating material on the face of the sheet, the feed roller must be withdrawn when the machine is re-equipped. For this reason a useful feature of the invention consists in that the feed means for the coating material which in the conventional manner substantially comprise a fountain roller dipping into a supply of coating material, a feed roller accepting the coating material from the fountain roller and transferring the same as a film of the

desired thickness to the coating roller, as well as adjusting means, are mounted as a unit assembly on a common frame portion which can be advanced and retracted a distance that makes allowance for the different diameters of the coating rollers that can be fitted into the machine.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other useful features of the invention will be understood as the following description of embodiments of the invention proceeds, in which reference will be made to the accompanying drawings which are illustrative schematic side elevations of essential parts of the proposed machine.

FIG. 1 is a machine for coating the entire surface of sheets by means of a rubber roller,

FIG. 2 is a machine for coating required parts of the surface of sheets, and

FIG. 3 is the coating machine according to FIG. 2 showing the sheet feed means in raised position.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the coating machine illustrated in FIG. 1 a roller 1 has a polished rubber covering. The purpose of this roller 1 is to apply a coating material to sheets that are conveyed from right to left in FIG. 1 through the gap between the coating roller and a cooperating counter-roller 2. The coating roller 1 obtains the coating material from a feed assembly marked 3 substantially comprising a fountain roller 4, a feed roller 5 and a fountain 6 for the coating material. The fountain roller 4 dips into the fountain and transfers parts of the material which it picks up to the feed roller 5 which transfers a desired thickness of film to the coating roller 1. Adjusting means 7 and 8 are provided to adjust the roller clearances and the required thicknesses of the film of material that is transferred from the fountain roller 4 to the feed roller 5 and from said feed roller to the coating roller 1.

The counter-roller 2 is a format roller. A rubber blanket 9 is wrapped around its circumference and clamped in position. Underneath the rubber blanket 9 is an insert which in size corresponds to the format of the sheet that is to be coated. This insert creates a slightly elevated backing for the sheet. Consequently the coating material will be applied by the coating roller 1 only to the sheet and not to other parts of the format roller 2.

The individual sheets are positioned in relation to the insert by conventional gripper feed means travelling in an endless path at the peripheral speed of the format roller 2. The gripper feed means comprise two chains 10 adjacent the side faces of, and driven by the format roller 2. They are mounted on cross members spaced between the chains 10 at equidistant intervals but not shown in the drawings. These grippers consecutively grip the sheets at the machine entry side, draw them through the gap between the two rollers 1 and 2 whilst being received into a longitudinal recess 11 in the format roller 2, and convey the sheets into proximity with a pair or return wheels 13 mounted some distance away on a cantilever frame 12, where the sheets are released.

There is no contact pressure between the coating roller 1 and the format roller 2, these two rollers being adjusted to the appropriate clearance for the coating to assume the required thickness. For this purpose the format roller 2 has a fine adjustment for elevation, as illustratively indicated in FIGS. 2 and 3 by an eccentric bearing 15 for the format roller shaft 16, and a worm 14 for rotating the eccentric bearing.

The diameter of the coating roller 1 is significantly less than that of the format roller 2. It has been found that the uniformity of the coating applied by the coating roller 1 is disturbed at higher speeds before it makes contact with the sheet if the diameter of the roller exceeds a given size. Coating roller 1 and format roller 2 also have slightly differing peripheral speeds to generate a gentle rubbing action of the coating material.

For changing the machine over from the described process of coating the entire surface of the sheets, as shown in FIG. 1, to coating only one or more parts of the surface of the sheets, the smooth coating roller 1 is removed and replaced by a screen roller of the same diameter, and driven at the same speed as the format roller 2. In order to facilitate dismantling and assembling the rollers the coating roller 1 is mounted in special chocks 17 which are received into ways 18 in bearing supports 19 which they are bolted to.

Referring to FIG. 2 in which the same reference numerals as in FIG. 1 identify like parts, the screen roller 20 which has replaced the smooth coating roller 1 (FIG. 1) is likewise mounted in suitable chocks 21. Owing to the larger diameter of the screen roller 20 these chocks 17 are higher than those shown in FIG. 1, but they fit into the same ways 18 of the bearing supports 19. The same holes can also be used for bolting the chocks in position.

The position of the feed roller 5 must be adjusted to the larger diameter of the screen roller 20. In order to simplify this operation it is useful to combine the entire feed assembly 3, substantially comprising the fountain roller 4, the feed roller 5 including the adjusting means 7 and 8, and the fountain 6 itself, in a single unit assembly. This may be mounted in a special portion 22 of the frame attached by screws 23 to its base. After undoing these screws 23 the entire multi-component feed assembly 3 can be moved back a suitable distance determined by tapped holes 24 for the reception of the screws 23.

The screen roller 20 is provided, directly on its surface or on a metal plate thereon, with a screen similar to that used in photogravure, the screen covering those parts which correspond to the parts on the sheets that are to be coated. In order to remove from the regions outside the cells of the screen the unwanted coating material which has been applied to the entire surface of the screen roller 20, a doctor 25 is used which is mounted, together with its holder, on fixing means 26. In the simplest case the latter may merely be tapped holes for the reception of fixing screws.

Whereas in a machine equipped with a rubber coating roller for coating the entire surface of the sheets the format roller is not submitted to contact pressure and may therefore be of light-weight construction, it is called upon, in the embodiment of the machihe according to FIGS. 2 and 3, to press the sheet against the screen roller with a considerable amount of pressure, as in gravure printing. The format roller 2 is therefore designed for withstanding such high pressures and remains in the machine even when the entire face of the sheet is to be coated and a rubber coating roller 1 (FIG. 1) is used.

Consequently, if it is desired to re-equip a machine using a rubber coating roller for coating the entire

sheet surface for the purpose of coating only parts of the sheet surface, it is in practice only necessary, apart from one or two minor changes to be made in the machine itself, to provide an additional screen roller and a doctor, i.e., an expense which is in no way comparable to the cost of a second machine.

The change-over itself is likewise not very difficult and can be accomplished within a short time. The work can be significantly facilitated if the cantilever frame 12 carrying the pair of return wheels 13 can be hingeably raised. For this purpose the cantilever frame 12 which substantially consists of two sides that are connected together at suitable points may be hinged coaxially with the format roller shaft 16, either on this shaft itself or in a machine frame 27 in alignment therewith, the cantilever frame resting on supports provided on the machine frame 27 when in the working position shown in FIGS. 1 and 2. Lifting means, such as hydraulic ram cylinders 28 attached to each cantilever half, may conveniently be provided for raising the frame 12. To avoid the coating roller 20 or 1 (FIG. 1) being in the way, this roller may be retractable. For this purpose the bearing supports 19 may have extensions which carry the frame portion 22 supporting the coating roller assembly, the extensions forming a slide 30 movable in special ways in the machine frame 27. Two coupling rods 29 may be linked at one end to side members of the cantilever frame 12 and at the other end to the slide 30 in such a manner that when the cantilever frame 12 is raised the slide 30 will be automatically moved out of the way together with the assembly which it supports. When the cantilever frame 12 is raised the delivery side of the machine is fully accessible for the insertion and adjustment of the inserts on the format roller 2, for cleaning the rollers, exchanging the coating rollers 1 or 20 for inspecting, repairing and so forth.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The embodiments are therefore to be considered in all respects as illustrative and not restrictive.

What is claimed is:

1. A coating machine comprising (a) a frame, (b) a format roller rotatably mounted on the frame, (c) a pair of supports mounted on the frame parallel to the axis of the format rollers and operable to receive chock elements, (d) a first roller and chock assembly comprising (i) a pair of chocks mountable in the supports and (ii) a coating roller rotatably mounted in its associated chocks and being of a diameter smaller than that of the format roller, the chocks of said first assembly being of a height sufficient to dispose said coating roller and said format roller in parallel coating aligment without contact pressure, and (e) a second roller and chock assembly interchangeable with the first roller and chock assembly and comprising (i) a pair of chocks mountable in the support and (ii) a screening roller rotatably mounted in its associated chocks and being of the same diameter as said format roller, the chocks of said second assembly being of a height sufficient to provide contact pressure between said format roller and said screen roller.

2. A coating machine as defined in claim 1 including (a) coating material feeding means detachably mounted on said frame, said means comprising (i) a fountain roller operable to dip into a coating material reservoir, (ii) a second feed roller accepting coating material from said fountain roller and transferring the same to a third roller, said third roller being either said coating roller or said screen roller, (iii) means for adjusting the distance between the fountain roller and feeder roller and (iv) means for adjusting the distance between the feeder roller and said third roller, and (b) means for moving said coating material feeding means from a first position on the frame when said first roller and chock assembly is disposed in said supports to a second position when said second roller and chock assembly is disposed in said supports.

3. A coating machine as defined in claim 2 wherein said feeding means includes a doctor disposed to engage the screening roller when said second roller and chock assembly is disposed in said supports but not the coating roller when said first roller and chock assembly is disposed in said supports.

4. A coating machine as defined in claim 1, including stock feeding means, said feeding means comprising two endless chains with grippers mounted thereinbetween, said chains running at one end over chain wheels disposed coaxially with the format roller and at the other end over chain wheels disposed away from the delivery side of the rollers, said chain wheels being mounted on a cantilever frame which is hingeably raisable coaxially with the axis of the format roller.

5. A coating machine as defined in claim 4, wherein the supports and feeding means are slideably mounted on the frame.

6. A coating machine as defined in claim 5, wherein the cantilever frame is coupled to the feeding means and supports so that raising the cantilever frame about its hinge displaces the support and feeding means from their working position and lowering the cantilever frame returns the support and feeding means to their working position.

* * * * *

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United States Patent [19]

Egnaczak

[11] **3,800,743**

[45] **Apr. 2, 1974**

[54] **MATERIALS APPLICATION APPARATUS**

[75] Inventor: **Raymond K. Egnaczak,** Williamson, N.Y.

[73] Assignee: **Xerox Corporation,** Rochester, N.Y.

[22] Filed: **Mar. 1, 1971**

[21] Appl. No.: **119,914**

Related U.S. Application Data

[62] Division of Ser. No. 876,646, Nov. 14, 1969, Pat. No. 3,609,029.

[52] U.S. Cl. **118/259,** 117/17.5, 118/DIG. 23, 118/241, 118/637

[51] Int. Cl. **B05c 1/06,** B05c 1/08

[58] Field of Search .... 118/DIG. 23, 637, 104, 118/203, 258, 259, 241, 242, 260, 268, 266, 50; 117/17.5, 37 LE

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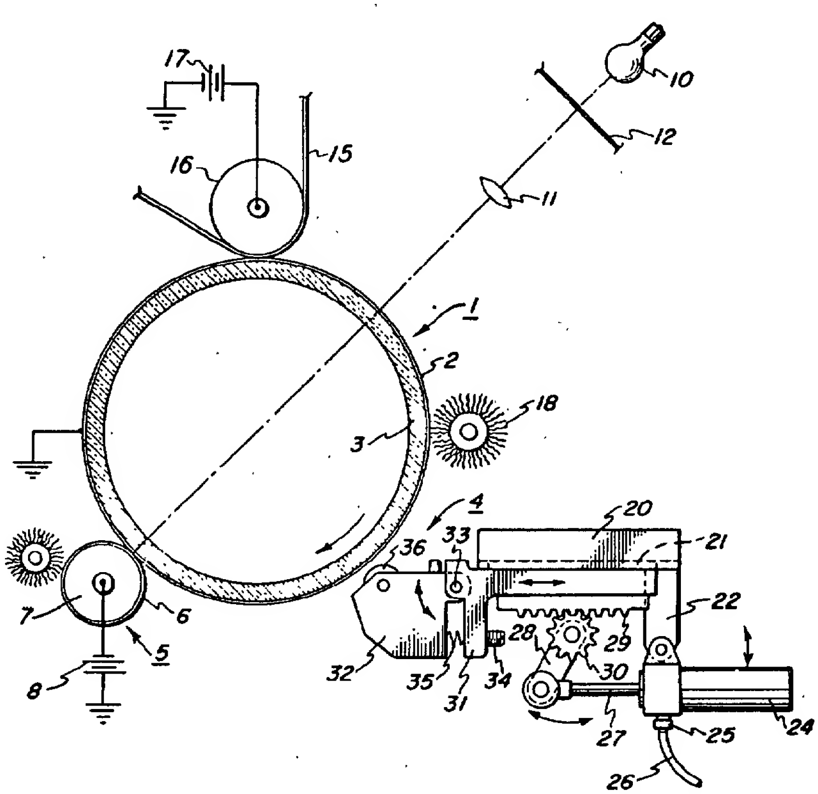
Primary Examiner—Mervin Stein
Assistant Examiner—Leo Millstein

[57] **ABSTRACT**

Apparatus for coating materials onto a surface comprising a housing pivotally connected to a carriage, a chamber and applicator within the housing. The pressure of the applicator against the surface to be coated is adjusted by varying the pivot of the housing containing the applicator relative to the carriage. The entire apparatus is advanced automatically into and out of contact with the surface to be coated. An alternative embodiment with an extruder applicator is also disclosed.

9 Claims, 4 Drawing Figures



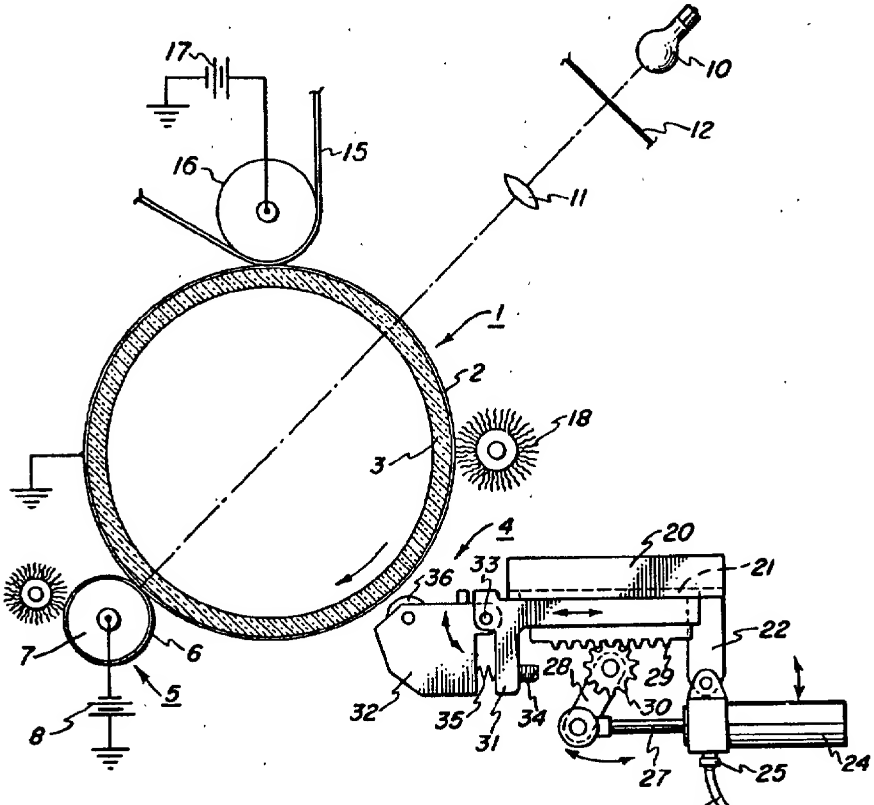

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FIG. 1

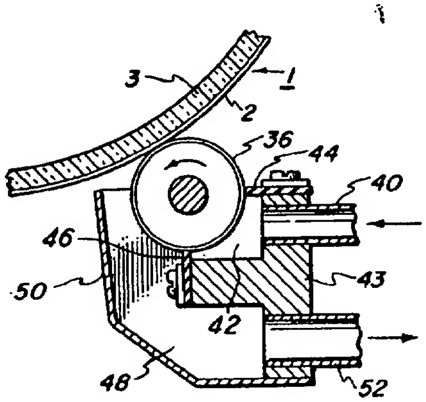
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FIG. 2

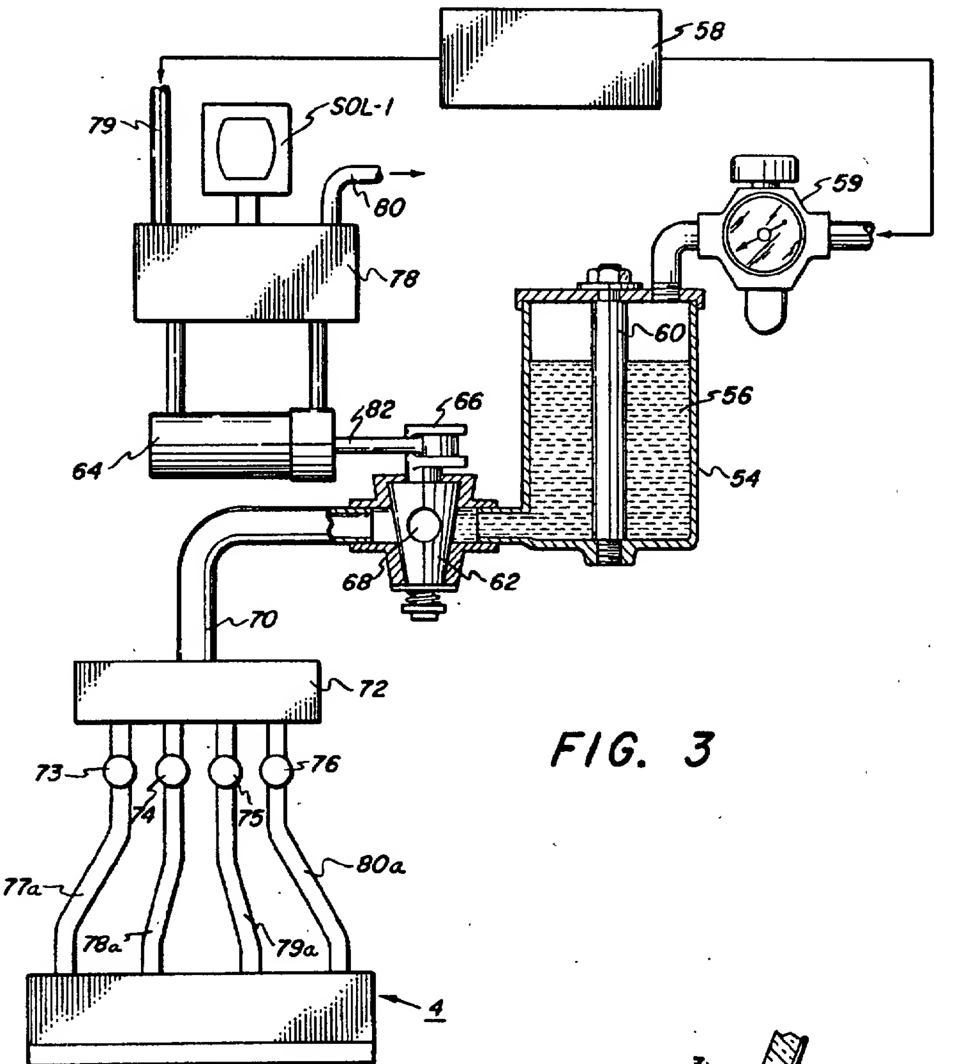
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FIG. 3

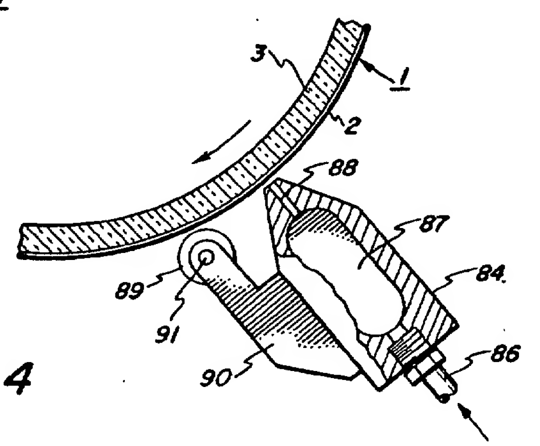
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FIG. 4

MATERIALS APPLICATION APPARATUS

This is a division of application Ser. No. 876,646, filed in the United States, Nov. 14, 1969, now U.S. Pat. No. 3,609,029.

This invention relates to coating systems and in particular to a fluid extruder system.

Systems exist that require working with layers of fluids, especially viscous liquids, that must be uniformly applied to a surface for working on the surface. One such system improved by a uniform coating technique and by the invention herein is the photoelectrophoretic imaging process. A detailed description of this process is given in U.S. Pat. Nos. 3,384,565, 3,384,566 and 3,383,993. These patents disclose how to produce a visual image at one or both of two electrodes between which a photoelectrophoretic particle suspension is placed. The particle suspension is comprised of photosensitive particles suspended within an insulating liquid carrier. The particles appear to undergo a net change in charge polarity or a polarity alteration by interaction with one of the electrodes upon exposure to activating electromagnetic radiation. The theory of operation is that the particles have a net charge when suspended in the liquid carrier and are attracted to the electrodes under the influence of an electrical field placed between them. Mixtures of two or more differently colored particles can secure various colors of images. The particles will migrate from one of the electrodes under the influence of an electric field when struck with energy of a wavelength within the spectral response of the colored particles.

Since the disclosure of the basic processes, continuous imaging machines have been disclosed, for example, in U.S. Pat. No. 3,427,242. It becomes important to be able to supply uniformly thin layers of the imaging suspension to one of the electrodes in such automated devices in order to form the best possible images from the machine.

It is also helpful in many instances to stress the suspension with a shear stress. This apparently improves the imaging qualities of the suspension.

Therefore, it is an object of this invention to improve fluid coating means. Another object of this invention is to improve means for uniformly coating liquids on a surface. Still another object of this invention is to extrude fluids onto a surface. Yet another object of this invention is to pre-stress fluids for application to a surface.

The invention herein is described and illustrated in a specific embodiment having specific components listed for carrying out the functions of the apparatus. Nevertheless, the invention need not be thought of as being confined to such a specific showing and should be construed broadly within the scope of the claims. Any and all equivalent structures known to those skilled in the art can be substituted for specific apparatus disclosed as long as the substituted apparatus achieves a similar function. It may be that other processes or apparatus will be invented having similar needs to those fulfilled by the apparatus described and claimed herein and it is the intention herein to describe an intention for use in apparatus other than the embodiment shown.

These and other objects of this invention are accomplished by employing a system for forcing fluids to a moving surface through an extruder mechanism adapted to supply a uniformly thin coating of the fluid on the surface moving thereby. A smoothing means and a pulsed fluid manifold ensure the uniformity of the thin layer of fluid on the coated surface. These and other objects and advantages of this invention will become apparent to those skilled in the art after reading the description in conjunction with the accompanying drawings wherein:

FIG. 1 schematically represents an embodiment of this invention in conjunction with a photoelectrophoretic imaging system;

FIG. 2 is a close-up of the application member with portions broken away to show internal structure;

FIG. 3 is a fluid supply system shown, for example, for use in conjunction with the apparatus of FIG. 4; and

FIG. 4 shows an alternative embodiment of apparatus according to this invention.

There are certain terms of art used in conjunction with the photoelectrophoretic imaging process that should be defined. The "injecting electrode" is so named because it is thought to inject electrical charges into activated photosensitive particles during imaging. The term "photosensitive" for the purposes of this disclosure refers to the property of a particle which, once attracted to the injecting electrode, will alter its polarity and migrate away from the electrode under the influence of an applied electric field when exposed to activating electromagnetic radiation. The term "suspension" may be defined as a system having solid particles dispersed in a solid, liquid or gas. Nevertheless, the suspension used in the disclosure herein is of the general type having a solid suspended in a liquid carrier. The term "imaging electrode" is used to describe that electrode which interacts with the injecting electrode through the suspension and which once contacted by activated photosensitive particles will not inject sufficient charge into them to cause them to migrate from the imaging electrode surface. The imaging electrode is covered with a dielectric surface composed of a material having a volume resistivity preferably in the order of 10^7 or greater ohm-cm and a conductive member which is preferably a resilient material such as a conductive rubber used to give flexibility to the imaging electrode.

For photoelectrophoretic imaging to occur it is thought that these steps, (not necessarily listed in the sequence that they occur) take place: (1) migration of the particles toward the injecting electrode due to the influence of an electric field, (2) the generation of charge carriers within the particles when struck by activating radiation within their spectral response curve, (3) particle deposition on or near the injecting electrode surface, (4) phenomena associated with the forming of an electrical junction between the particles and the injecting electrode, (5) particle charge exchange with the injecting electrode, (6) electrophoretic migration toward the imaging electrode, (7) particle deposition on the imaging electrode. This leaves an optically positive image on the injecting electrode.

The schematic representation of FIG. 1 shows a photoelectrophoretic imaging apparatus having an injecting electrode 1 with a coating of a transparent conductive material 2 such as tin oxide over a transparent glass member 3. Such a combination is commercially available under the name NESA glass from Pittsburgh Plate Glass Company of Pittsburgh, Pa. However, other electrically conductive transparent coatings over transpar-

ent substrates are suitable for use herein. Imaging suspension is applied to the surface of the injecting electrode by the extruder mechanism 4 where it is carried because of the motion of the injecting electrode to the imaging area between the injecting electrode and the imaging electrode 5.

The imaging electrode 5 has a surface 6 composed of a dielectric material sleeve and a conductive substrate 7 which is preferably a resilient material such as an electrically conductive rubber. The imaging electrode prevents sufficient charge injection into the particles to cause them to migrate from its surface. The imaging electrode is connected to a potential source 8 while the injecting electrode is shown as electrically grounded to give the necessary field affect at the imaging area between the two electrodes. An exposure mechanism including an illumination means 10 and a lens 11 presents a flowing image of the object 12 at the image area which coincides with the optical image plane. The image is moving at the imaging area at the same rate as are the moving surfaces of the injecting and imaging electrodes. The image thus formed at the imaging area is carried by the injecting electrode to the transfer station where it is transferred to a support sheet 15. The Transfer roller 16 is coupled to an electrical source 17 providing a field with the injecting electrode opposite in sign from that at the imaging area. A cleaning brush 18 removes residual particles from the surface of the injecting electrode so that the imaging cycle may be completed with other images being formed.

The extruder mechanism 4 is mounted on a brace 20 which has rails 21 therein. A stationary bracket 22 mounts an air cylinder 24 having an air inlet 25 and an air intake hose 26. The piston 27 of the cylinder, through the crank arm 28, moves a rack 29 and pinion 30 to engage and disengage the extruder in suspension application interface with the injecting electrode surface 2. The rack moves the extruder mounting 31 in the rails 21 of the brace 20.

The interfacing portion 32 of the extruder is pivoted about a pin 33 and is preset with an interface pressure adjusting screw 34 and an adjusting spring 35. The interfacing member shown in FIG. 1 is a smoothing rod 36 which can be grooved, wound wire, knurled, or smooth surfaced to present a uniformly thin layer of suspension on the injecting electrode surface.

FIG. 2 is a closeup of the interfacing portion 32 of the extruder with the side wall removed so that internal parts are seen. The suspension is pulsed in through the inlet tube 40 into a chamber 42 enclosed by the smoothing rod 36, a frame member 43, a coater blade 44 and a scraper blade 46. The smoothing rod 36 is driven with outboard oversize drive wheels pressed against the ends of the injecting electrode cylinder so that it moves when the wheels are in contact with the cylinder. A coater blade 44 limits the amount of suspension traveling around the periphery of the smoothing rod 36 for contact with the injecting electrode surface 2. The scraper blade 46 prevents used imaging suspension from contaminating the suspension held in the chamber 42 while preventing the suspension within the chamber 42 from leaking out of that chamber. The chamber 48 of the interfacing portion 32 of the extruder is a vacuum chamber for removing suspension materials within its housing walls 50. The materials are carried through the outlet 52 for removal from the vicinity of the injecting electrode and the imaging system. The drive wheels are larger in diameter than is the smoothing rod 36. The difference in diameter determines the clearance between the smoothing rod 36 and the surface 2. The thickness of the coated fluid on the surface is more or less equal to the clearance.

FIG. 3 demonstrates the gas and suspension supply system for the extruder. A few definitions of terms will be helpful at this point to more fully understand the use intended herein. A "negative pressure source" refers to a cylinder or other means which is partially evacuated of gases to lower its internal pressure below atmospheric pressure. Similarly a "positive pressure source" refers to a cylinder or other means containing a compressed gas to create an internal pressure greater than atmospheric pressure. The term "vacuum" refers to a negative pressure but not necessarily to an absolute void. The term "fluid" encompasses both gases and liquids The gases referred to are those commonly found in the atmosphere and identified generally as air.

The imaging suspension holding tank 54 maintains a quantity of imaging suspension 56 in its hermetically sealed chamber. Gases from the positive pressure gas source 58 enter the tank 54 through a gas regulator 59 which sets the positive pressure in the suspension holding tank 54. The mechanism 60 maintains the seals in the closure of the tank to prevent fluids escaping therefrom.

To reach the extruder 4, the suspension must pass through a valve 62 operated by a cylinder 64 and a crank arm linkage combination 66. The valve has a passage way 68 therein which, when turned in the proper direction, permits a pulsed shot of suspension to pass through the conduit 70 to the distribution manifold 72 for passage through the individual ink flow metering valves 73–76. The valve 62 is opened and closed by the action of the solenoid SOL-1 and the 4-way valve 78 having a gas intake conduit 79 and an exhaust conduit 80. The solenoid and 4-way valve operate to move the piston 82 of the cylinder 64 to rotate the valve 62 thus opening and closing the passageway. This connects the suspension 56 from the tank 54 to the conduit 70 allowing for pulsed shots of suspension through the distribution manifold 72 and conduits 77a-80a to the extruder 4.

An alternative embodiment for an extruder mechanism is shown in FIG. 4. An extruder housing 84 with a suspension intake connection 86 has an internal chamber 87 for accumulating suspension. The suspension is forced through the extruder at the exit aperture 88 for application to the surface 2 of the injecting electrode 1. To ensure that a smooth uniform layer of suspension moves to the imaging area, a smoothing rod 89 is placed downstream from the extruder along the path of movement of the surface. The smoothing rod is journaled through the support bracket 90 of a shaft 91 to freely rotate while being driven by the injecting electrode 1.

While this invention has been described with reference to the structures disclosed herein and while certain theories have been expressed, it is not confined to the details set forth; and this application is intended to cover such modifications or changes as may come within the purposes of the improvements and scope of the following claims.

What is claimed is:

1. A coating apparatus comprising:

a. a carriage;

b. a housing pivotally connected to said carriage;

c. an applicator mounted in said housing and adapted to be brought into contact with a surface to be coated;

d. a chamber defined by a portion of said housing, said chamber for maintaining a reservoir of coating material to be applied by said applicator;

e. pressure adjusting means to vary the contact pressure of said applicator against the surface to be coated by varying the pivot of said housing and said applicator relative to said carriage, wherein said pressure adjusting means is operatively connected between said carriage and said housing; and

f. drive means for advancing said carriage, said housing and said applicator into and out of contact with the surface to be coated.

2. Coating apparatus according to claim 1 wherein said applicator is a roller mounted for rotation in said housing and including in combination

a. a second chamber defined by a portion of said housing, said chamber for collecting coating material from the surface of said applicator roller after said roller has contacted the surface to be coated; and

b. removing means for removing uncoated material from said applicator roller portions after said portions have contacted the surface to be coated and to remove such material to said second chamber prior to the portions rotating into the chamber for maintaining a reservoir of coating material to be applied by said applicator.

3. The coating apparatus according to claim 2 wherein said removing means comprises a scraper blade which also separates said chamber and said second chamber.

4. Coating apparatus according to claim 3 wherein said second chamber is a vacuum chamber and further including in combination coating material removal means for removing coating material from said second chamber which has been scraped from said roller applicator.

5. Coating apparatus according to claim 3 including in combination supply means for supplying coating material under pressure to said chamber.

6. Coating apparatus according to claim 5 including in combination means for supplying metered amounts of coating material to said chamber comprising a pulsing valve means to enable pulsed shots of coating material to pass to said chamber.

7. Coating apparatus according to claim 3 further including in combination a smoothing means connected to said housing to form a uniform layer of coating material on the surface of said applicator roller after it has come in contact with coating material from said chamber but before it contacts the surface to be coated.

8. An extruder apparatus for applying coating material to a surface comprising:

a. a carriage;

b. an extruder housing mounted to said carriage, said housing defining an exit aperture;

c. a chamber defined internally by said housing, said chamber for maintaining a reservoir of coating material to be applied through the exit aperture;

d. supply means for supplying coating material to said chamber;

e. valve control means to enable pulsed shots of coating material to be supplied to said chamber and then through the exit aperture to a surface to be coated;

f. a smoothing rod mounted on said extruder housing downstream from said exit aperture along the path of movement of the surface to smooth the coating materials coated on the surface to be coated through the exit aperture; and

g. drive means for advancing said carriage, said extruder housing and said smoothing rod to and from the surface to be coated, so that said smoothing rod could be brought into and out of contact with said surface.

9. A coating apparatus comprising:

a. a carriage;

b. a housing pivotally connected to said carriage;

c. an applicator roller mounted for rotation in said housing and adapted to be brought into contact with a surface to be coated;

d. a chamber defined by a portion of said housing, said chamber for maintaining a reservoir of coating material to be applied by said applicator roller;

e. a second chamber defined by a portion of said housing, said chamber for collecting coating material from the surface of said applicator roller after said roller has contacted the surface to be coated;

f. removing means for removing uncoated material from said applicator roller portions after said portions have contacted the surface to be coated and to remove such material to said second chamber prior to the portions rotating into the chamber for maintaining a reservoir of coating material to be applied by said applicator, said removing means comprising a scraper blade which also separates said chamber and said second chamber;

g. pressure adjusting means to vary the contact pressure of said applicator roller against the surface to be coated by varying the pivot of said housing and said applicator roller relative to said carriage;

h. supply means for supplying coating material under pressure to said chamber, said supply means including means for supplying metered amounts of coating material to said chamber comprising a pulsing valve means to enable pulsed shots of coating material to pass to said chamber; and

i. drive means for advancing said carriage, said housing and said applicator roller into and out of contact with the surface to be coated, said drive means for advancing said carriage comprising:

i. a stationary brace slideably mounting said carriage,

ii. a rack mounted on said carriage,

iii. a rod,

iv. rod drive means for advancing said rod,

v. a pinion engaging said rack, and

vi. a crank arm connecting said rod and said pinion to translate the movement of said rod to said carriage.

* * * * *

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United States Patent [19]

Knodel et al.

[11] 3,916,824

[45] Nov. 4, 1975

[54] **DEVICE FOR COATING STRIP MATERIAL IN CONTINUOUS OPERATION**

[75] Inventors: **Peter Knodel**, Leonberg; **Gerhard Mayer**, Leinfelden; **Horst Munsterer**; **Reinhold Wagner**, both of Neuss, all of Germany

[73] Assignee: **Aluminium Norf GmbH**, Neuss, Germany

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[21] Appl. No.: **500,073**

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[51] **Int. Cl.**^{2} **B05C 1/00**

[58] **Field of Search** 118/61, 68, 223, 224, 246, 118/249, 258, 259

[56] **References Cited**

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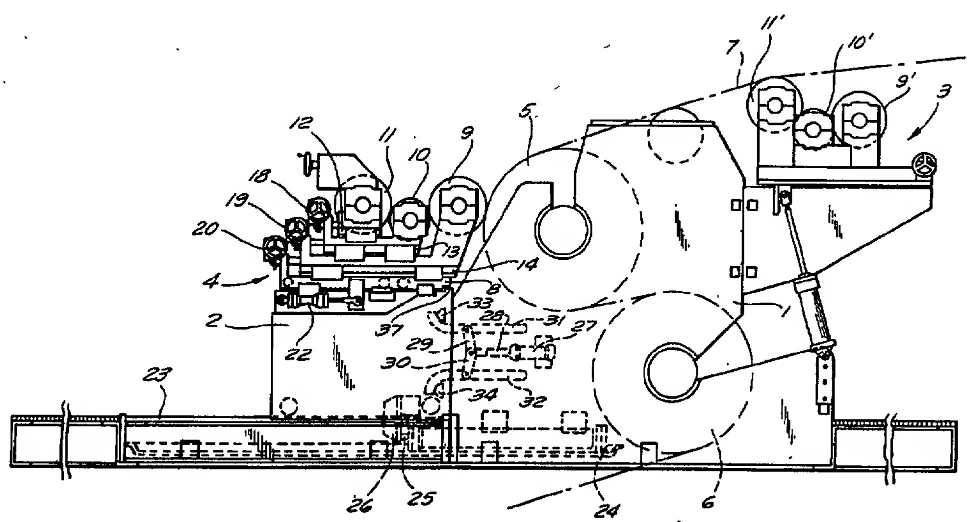
Primary Examiner—Mervin Stein
Assistant Examiner—Steven Hawkins
Attorney, Agent, or Firm—Hane, Baxley & Spiecens

[57] **ABSTRACT**

There is disclosed a coating device for coating bands or ribbons with a coating material in continuous operation. The coating device comprises a main frame which mounts one or two deflector rollers for guiding and conveying the band or ribbon material to be coated. Coating is effected by a coating assembly which includes a fountain roll, a metering roll and an applicator roll which are disposed in axially parallel relationship and are adjustable relative one to another and relative to the band or ribbon to be coated as it is guided over one of the deflector rollers. The coating assembly is mounted on an auxiliary frame which is displaceable in the direction normal to the deflector roller over which the ribbon or band is guided. The auxiliary frame, in turn, is displaceable relative to the main frame for the purpose of making the rolls in the coating assembly conveniently accessible for cleaning or other servicing. There is further disclosed an installation including one or more coating devices in superimposition, each enclosed by an enclosure and drying and burning assemblies for purifying obnoxious or toxic pollutants entrained in the air passed through the enclosures of the coating devices before the air is discharged in the atmosphere.

11 Claims, 3 Drawing Figures



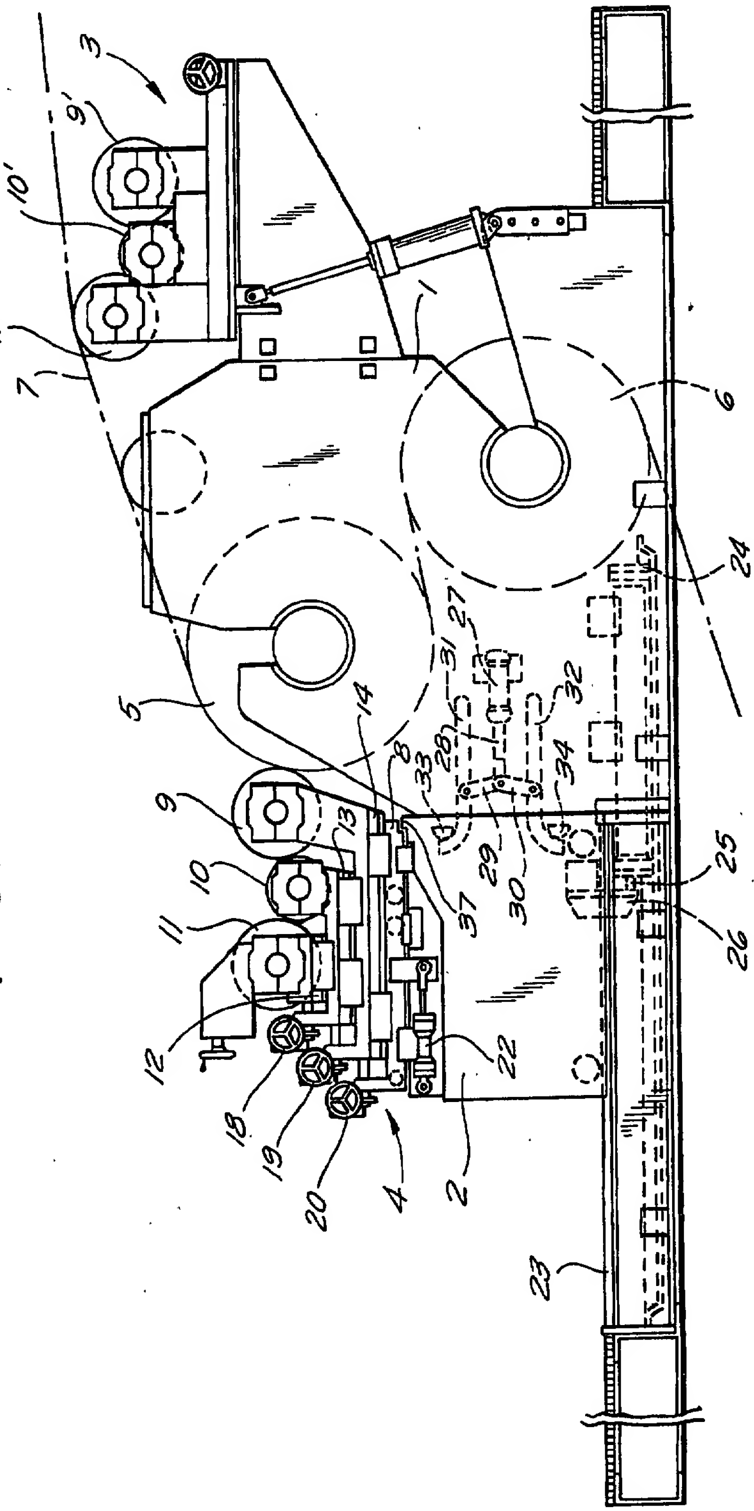
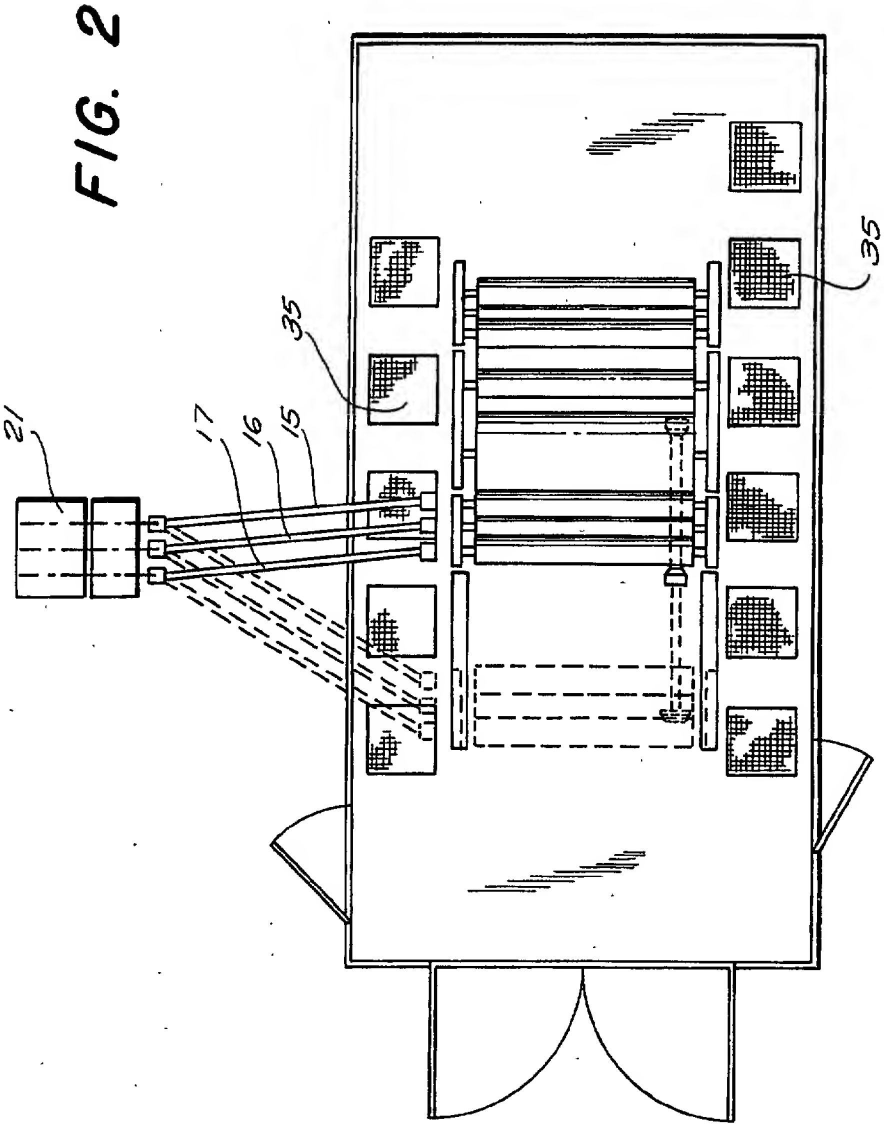


FIG. 1

FIG. 2



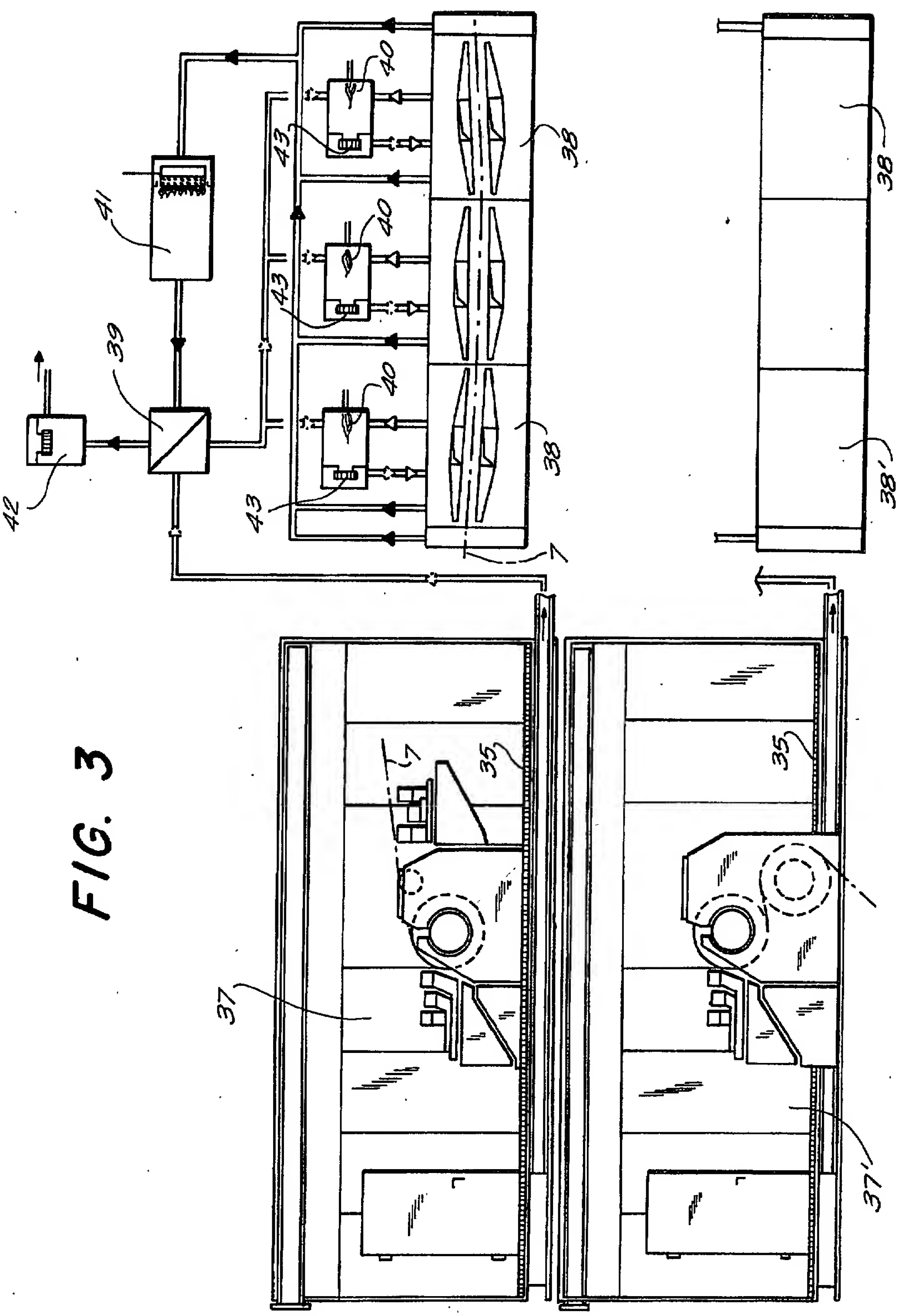


FIG. 3

DEVICE FOR COATING STRIP MATERIAL IN CONTINUOUS OPERATION

The invention relates to a coating device for coating material in ribbon or band form in continuous operation and also to an installation which includes such coating devices and purifying means for removing pollutants entrained in the air used for accelerating drying of the coating material after application thereof before the air is discharged into the atmosphere.

BACKGROUND

There are known coating devices of the general kind above-referred to which include one deflector roller or an upper and a lower deflector roller for guiding and conveying the band or ribbon material to be coated in continuous operation. In many instances the quality specifications with respect to the uniformity of the coating on the band or ribbon material is much greater for one side of the material than for the other side. In that case, the coating device for producing the high quality coating comprises a fountain roll for taking-up coating from a source of supply, a metering roll and an applicator roll. Such coating device for producing the high quality coating is mounted on a frame structure so that its position can be adjusted relative to the respective deflector roller.

Installations for coating band or ribbon material frequently comprise two coating devices to permit rapid changing from one type of coating material to another; for instance, it may be desired to change the color or the coating material. If two or even more coating devices are provided, the devices are generally arranged in superimposition and mounted on a common frame structure detachable therefrom. With an installation of this type, the band or ribbon side to be coated with the high quality coating being generally the upwardly facing sides, it becomes necessary to effect a thorough cleaning of the rolls of each coating device before a change in color or coating material can be effected. As is evident, if the cleaning is not thoroughly made any residues of the previously used material will cause irregularities in the coating made after the cleaning of the coating device.

The need for such thorough cleaning of the coating devices is well understood in the art and to make such cleaning possible it is known to arrange the coating devices in the installation so that each of the coating devices can be laterally withdrawn to assure that the coating devices are accessible for cleaning. The disadvantage of such laterally displacement as is now known is that considerable space is required for the coating device itself and such high space demand, in turn, greatly enlarges the total space required for the complete coating installation, i.e., including the assembly or assemblies needed for removing of pollutants that are unavoidably entrained in air passed through the coating devices. Virtually all coating materials contain volatile pollutants that are noxious and sometimes even toxic so that the air must be thoroughly purified before it can be discharged into the atmosphere. Arrangement of two superimposed coating devices, each coacting with a deflector roller makes it difficult to provide adequate accessibility to the fountain roll, metering roll and applicator roll of the coating devices for the purpose of thorough cleaning. In particular, considerable difficulties are encountered if the rolls of both coating devices are to be cleaned.

Moreover, lateral withdrawal of the rolls of each of the coating devices for purpose of cleaning also requires that each such roll is detached from its drive and such detachment, in turn, creates another problem since thorough cleaning of the rolls must be made while the rolls are turning. Hence, to effect such turning the rolls must be coupled to an auxiliary drive. After completion of the cleaning each roll must be detached from the auxiliary drive and re-attached to the drive of the device. All such decoupling, cleaning and recoupling obviously requires considerable time and labor and, thus, a corresponding increase in costs.

The sealed enclosure of the installation, i.e., the enclosure in which the coating device proper is located, is connected with a suitable suction pump for sucking off the volatile components released by the coating material. Such suction pump and the conduits connected therewith should be laid out so that a rapid air exchange is obtained to provide acceptable air conditions for the service personnel. The volume of air discharged from the space in which the coating is carried out can be fully fed to the drying assembly for drying of the coating material applied in the coating device only if and when this volume of air does not exceed the air requirements of the drying assembly. The drying assembly is coupled in its downstream position with an after-burning device. The purpose of such after-burner is to assure reasonably complete elimination of noxious or toxic pollutants. The level of air purification is generally controlled by strict codes which provide that the air discharged into the atmosphere cannot include more than a definite maximal percentage of pollutants.

To hold the operational costs of such after-burner assemblies as low as possible, efforts have been made to assure that the total volume of discharged air is reduced to an absolute minimum. To obtain optimal operational conditions for the installation it is advantageous that the total volume of air discharge can be processed in one after-burner assembly. However, such processing of the total air volume presupposes that the volume of air is discharged from the enclosure including one or more coating device can be fed to a drying assembly. This is only possible if the enclosed and sealed space for the coating devices, i.e., the overall dimensions of the enclosures for the coating devices is already at a minimum.

THE INVENTION

It is a broad object of the invention to provide a novel and improved coating device of the general kind above referred to in which the enclosure for the coating device and the coating device itself are reduced to minimal dimensions while at the same time obtaining maximal accessibility of the coating device for cleaning and other servicing.

Another object of the invention is to provide a novel and improved installation so arranged that the air flow which, after passing through enclosures for the coating device or devices has entrained therein pollutants, is limited to a volume of air which can be purified at optimal conditions.

SUMMARY OF THE INVENTION

The afore-pointed out objects, features and advantages and other objects, features and advantages which will be pointed out hereinafter are obtained by provid-

ing a coating device including a main frame structure, an auxiliary frame structure and a coating applicating assembly. The auxiliary frame structure supports the applicating assembly so that the same is displaceable in the direction normal to the path of the band or ribbon to be coated and is, in turn, supported by the main frame structure so that it can be displaced relative to said frame structure and also be detached therefrom. As a result, the over-all dimensions of the enclosure for the coating device can be selected so that the volume of air which must be passed through the enclosure during the coating operation can be held within limits which permit purification of the discharged air under optimal conditions and thus the volume of air continuously sucked out from the enclosure during a coating operation remains continuously at a rate which allows the use of economically acceptable after-burner assemblies. The discharge openings in the enclosures now need to be provided lengthwise of the bottom of the enclosure extending rows while heretofore additional crosswise extending air discharge openings were required.

The installation according to the invention further provides optimal accessibility of the coating devices proper so that servicing thereof, especially if, for instance, change in the color of the coating material is to be effected, can be carried out without considerable loss of time and without likelihood of insufficient cleaning of the rolls and other components of the coating device that need cleaning in case of change in the coating material.

After withdrawal of a coating device into the servicing position by a suitable power drive such as a servo system, the service personnel can clean or otherwise service the rolls of the coating devices while the rolls continue to rotate, as it is necessary for thorough cleaning and to effect such cleaning without first disconnecting the rollers from their operational drive means.

More specifically, the thorough cleaning of the rolls and other parts of the coating devices can be effected as sufficient space is available in a coating device according to the invention between the coating devices proper and the deflector roller over which the band or ribbon to be coated is guided during coating. Heretofore it was necessary for this purpose to effect time-consuming and complex lateral withdrawal or complete detachment of the coating device by means of a hoist. Such cleaning and other servicing of a coating device also results in avoidance of damage to the rolls which are comparatively expensive. Saving or reduction of the time required for cleaning the rolls of the coating device, and especially the applicator roll to effect rapid readying of the device in case of change in the color of the coating material or use of other coating materials, is of considerable economic significance, the more so as modern technique desires high conveying speeds for the band or ribbon to be coated. The importance of rapid readying of the coating device for re-start with a changed coating material is particularly important if comparatively small lots of bands or ribbon are to be coated. Obviously, the smaller the lot to be coated is, the more it becomes economically important to ready the entire installation for resuming operation with the changed coating material.

The invention also provides that the afore-referred to auxiliary frame structure is coupled to the main frame structure by means of clamping means which can be power operated, for instance by servo systems using hydraulic or air pressure. The use of such clamping means

permits locking of the auxiliary frame structure to the main frame structure without tendency to vibrate, and simultaneously makes it easy to release the auxiliary frame structure from the main frame structure.

More specifically, operation of the clamping means is effected according to the invention by a power drive such as a cylinder-piston servo-system in which the connecting rod for the piston of the system mounts an angle lever mounting and operating clamping elements which are releasably engageable with complementary clamping elements on the auxiliary frame structure.

According to a further aspect of the invention, the auxiliary frame structure can be displayed relative to the main frame structure by a servo-system or other power drive which is mounted on the main frame structure. By operating this system, the auxiliary frame structure and with it the coating assembly supported on the same can be automatically detached from the main frame structure thereby obtaining clear space which is amply sufficient to carry out a thorough cleaning operation of the entire coating device without difficulty.

The air discharge and purifying parts and conduits which are disposed laterally of the main frame structure and the auxiliary frame structure can be used for immediate sucking out of air containing volatile pollutants or contaminants as may be released during a cleaning operation.

To permit continuous operation even during change of the coating material, the invention also provides that several coating devices are disposed each in a separate enclosure and in superimposition. These enclosed coating devices are connected with a common drying assembly and an after-burner assembly downstream of the drying assembly. The total discharge of contaminated air from the enclosures is fed to the drying assembly and the burner assembly by means of a suitable suction pump. Since the volume of air discharged from the enclosures in which the coating is carried out does not exceed the volume of air which can be accepted by the drying assembly, the total volume of air which contains a comparatively low amount of pollutants can be safely fed to the drying assembly. Additional content of pollutant as may be released in the drying assembly can subsequently be removed in the after-burner assembly. As a result, an additional after-burner assembly for the air discharged from the space in which coating is effected is thus avoided.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawing, preferred embodiments of the invention are shown by way of illustration and not by way of limitation.

In the drawing:

FIG. 1 is a diagrammatic elevational view of a coating device for coating both sides of a band or ribbon material in continuous operation;

FIG. 2 is a simplified plan view of FIG. 1; and

FIG. 3 is a diagrammatic elevational view of an installation including coating devices according to FIG. 1 disposed in superimposition for simultaneously or singly coating ribbons or bands and further including an air-purifying device.

DETAILED DESCRIPTION OF THE DRAWING

Referring now to the figures in greater detail, and first to FIG. 1, the coating device exemplified in this figure comprises a main frame structure 1 and an auxiliary frame structure 2. These frame structures mount

separate coating devices 3 and 4.

The main frame 1 further mounts two rotary deflector rollers 5 and 6 which serve to guide and convey a band or ribbon 7 to be coated. The auxiliary frame structure 2 mounts coating device 4 which is slidable relative to this frame structure by means of a guide slide 8. The coating device 4 is designed for coating the top or exposed side of band or ribbon 7 while coating device 3 serves for coating or otherwise treating the back side of the band or ribbon. The coating material may be any material suitable for the purpose, such as a dye, paint, lacquer, liquefied plastic, etc. Both coating devices are substantially alike as to their functional arrangement except that the coating device 4 being designed for coating the top side of the band or ribbon must be and is designed to effect a coating which satisfies high demand for uniformity, accuracy and similar requirements. Accordingly, device 4 includes various adjustment and control means which are not required for coating device 3 if, as is frequently the case, the demands on the quality of the coating on the back side are much lower than those for the coating of the top side.

Coating device 4 comprises an applicator roll 9, a fountain roll 10 for taking-up the coating material to be applied, and a metering roll 11. Similarly, the coating device 3 comprises an applicator roll 9', a fountain roll 10' and a metering roll 11'.

In addition to the afore-listed rolls, coating device 4 comprises guide carriers or slides 12, 13 and 14, each supporting one of the rolls. The positions of these slides and thus of the rolls relative one to another are adjustable by fine setting means such as hand wheels 18, 19 and 20 so that the cylindrical wall of the rolls are in coacting engagement, or in other words, the peripheral surface of one of the rolls rolls off the peripheral surface of the adjacent roll or rolls. Each of the three rolls is drivingly coupled by couplings 15, 16 and 17, respectively, with a separate drive means 21 (see FIG. 2).

Moreover, the entire coating device 4 can be by means of guide slide 8 which carries the guide slides 12, 13 and 14, displaced relative to the upper deflector roller 5 by means of a cylinder-piston-servo means 22 having a short stroke until stopped by an adjustable stop 37. The servo means 22 can be driven hydraulically or by air pressure. The purpose of the servo means is to move the coating device clear of the band when and while joints of lengths of band or ribbon pass the coating device, as such joints generally are somewhat thicker than the normal thickness of the band. After the passage of such joint the coating device is returned into its coating position. Control of the servo means can be automatically effected, for instance, by means of photocells or other control means conventional readily available in the market. The application of coating material is effected by transfer of material taken up by fountain roll 10 to metering roll 11, and finally, to applicator roll 9, which applies the coating material upon the upward facing band or ribbon 7 as the same is being guided and conveyed by deflector roll 5.

If the coating material is to be changed, for instance if material having a different color is to be used, rolls 9, 10 and 11 of coating device 4 and possibly other components thereof must be very carefully cleaned to prevent faulty coating such as discoloration, spots, etc. For the purpose of such cleaning, the entire coating device 4 can be displaced in the lengthwise direction of the coating device, that is, normal to the axis of roller 5, to a position in which there is free and convenient access

to the device for cleaning the rolls and possibly other components.

To effect such convenient displacement of the coating device into and out of its operational position for the purpose of cleaning, the auxiliary frame structure 2 is displaceable on a guide means 23 which is mounted on the base or inserted into the base of auxiliary frame structure 2. Displacement of frame structure 2 is effected by suitable adjustment means such as a hydraulically operated servo-piston system 24. This servo-system is fixedly secured to main frame structure 1 and the piston rod 25 of system 24 can be moved into engagement with protrusions such as studs 26 on frame structure 2. Accordingly, by operating the servo system 24, its piston rod 25 can be used to move coating device 4 via auxiliary frame structure 2 into and out of its operational position

Setting of auxiliary frame structure 2 and coating device 4 relative to deflector roller 5 is effected in the following manner: First, piston rod 25 of servo system 24 is operated to couple frame structure 2 with frame structure 1. As a result, there is a force-transmitting connection between both frame structures by means of a further power operated, for instance, hydraulically by a cylinder-piston servo system 27. The piston 28 of this system mounts a linkage 29 and 30 to which are hinged locking elements 31 and 32 which, upon operation of servo-system 27 effect coupling with coupling noses such as discs 33 and 34 on auxiliary frame structure 2.

After connection of frame structure 2 to frame structure 1, fine adjustment of rolls 9, 10 and 11 is effected by hand wheels 18, 19 and 20, respectively.

Operation of coating device 3 is essentially the same as that of coating device 4, except that adjustment and clearing of rolls 9', 10' and 11' is not or only rarely required since the quality demands on the coating of the bottom side of band or ribbon are much less on the coating of the top side as previously explained.

Turning now to FIGS. 2 and 3, these figures show application of the invention to an installation including two or more coating devices so that minimum space requirement is combined with convenient servicing of the coating devices as hereinbefore described. Furthermore, the installation due to the arrangement of coating devices according to the invention can be so designed that the air released during operation of the coating devices can be conveniently and thoroughly purified. Many types of coating materials such as certain paints, dyes, etc. contain volatile components which are released during application and drying and are obnoxious or even toxic. Accordingly, purification of the discharged air is highly necessary and often required by local codes.

FIGS. 2 and 3 show diagrammatically an installation which fully utilizes the advantages of coating devices according to the invention. As it is shown in these figures, each of the two coating devices is enclosed in a separate sealed-off enclosure 37 and 37', respectively. The outside dimensions of these enclosures can be conveniently selected in accordance with the minimal space requirements of the main frame structure and the auxiliary frame structure of coating device 4. There are shown two coating devices disposed in superimposition and enclosed by enclosures 37 and 37', respectively. Of course, there may be several enclosures side-by-side on the same level. More than two coating devices and enclosures therefor can be superimposed. Drying air after being drawn through the enclosures for the coating de-

vices is fed via discharge ducts 35 to air-purifying assemblies as it is shown in FIG. 3 to the right of the coating devices. Ducts 35 are preferably arranged parallel to each other as it is shown in FIG. 3 and also parallel to the bottom of the enclosures, thereby reducing the required space to a minimum. Moreover, due to such arrangement, the required air volume can be maintained so that the discharge of the total air volume from enclosures 37 and 37' and the feed of this discharged air to the air purifying assemblies is made readily possible.

There is provided for each of the enclosures 37 and 37' an air-purifying assembly. The assembly for coacting with enclosure 37 is fully shown and described, but the assembly for enclosure 37' is only partly shown as the two assemblies are alike and function in the same manner.

The assembly coacting with enclosure 37 comprises a drying device 38 which, as shown, may be divided into several parts: a heat-exchanger 39, burners 40, one for each part of the drying device, an after-burner 41, a suction pump 42, and suction pumps 43, one for each burner 40. All these components are presumed to be of conventional design. The air used in enclosure 37 during the coating operations, which as previously becomes contaminated during and due to the coacting operations, is sucked out by means of suction pump 42 and fed via conduit 35 and heat-exchanger 39 to drying device 38. The drying process in device 38 removes most of the contaminants in the air. The air is then returned to heat-exchanger 39 and from this exchanger to suction pump 42 through which it is discharged into the atmosphere. To assure still further purification of the air, the after-burner 41 may be interposed between the drying device and the heat exchanger. It has been found that reheating of the air while being dried in drying device 38 is necessary or, at least, desirable. For this purpose, part of the air in the drying device is sucked out by suction pumps 43 and exposed to the heat of burners 40 which causes not only reheating of the air but also the burning of pollutants or contaminants still contained in the air. The sucked-off air is returned into the drying device to be discharged therefrom into the atmosphere together with the air remaining in the drying device. Dotted arrowheads indicate the feed of air from the enclosure 38 into the drying device and solid arrowheads indicate the flow of part of the air as caused by suction pumps 43.

As several coating devices are arranged in superimposition in FIG. 3 and each one is enclosed in an enclosure there is no undesirable delay in the carrying out of a coating operation in one of the coating devices when a change in the coating material is effected in another coating device. In other words, all coating devices can be kept in operation except the one in which a change in the coating material is made.

In case two superimposed coating devices are used for coating the top side of bands or ribbons within the same installation vibrations may occur when one of the coating devices is withdrawn for cleaning purposes or change in the coating material. The result of such vibrations would be irregularities in the coating as effected by the second coating device. This danger is avoided by providing separation of the coating devices by enclosures as it is shown in FIG. 3.

While the invention has been described in detail with respect to certain now preferred examples and embodiments of the invention, it will be understood by those skilled in the art, after understanding the invention, that various changes and modifications may be made without departing from the spirit and scope of the invention, and it is intended, therefore, to cover all such changes and modifications in the appended claims.

What is claimed is:

1. A coating device for coating bands with a coating material in continuous operation, said coating device comprising in combination:

a main stationary mounted frame structure;

rotary guide means for guiding band material to be coated, said guide means including at least one deflector roller and being mounted on said main frame structure;

a coating assembly for coating the side of the band outwardly facing on said roller, said assembly including a fountain roll for supplying coating material, a metering roll and an applicator roll disposed in axially parallel relationship one with the other and the deflector roller;

an auxiliary frame structure supporting said coating assembly, said auxiliary frame structure including guide means for slidably guiding said coating assembly as a unit in the direction normal to the rotary axis of the deflector roller for selecting varying positions of said assembly relative to said roller;

guide means on said main frame structure slidably supporting said auxiliary frame structure for selectively displacing the same in the direction normal to the axis as a unit relative to the main structure and thus relative to the deflector roller;

drive means for moving said auxiliary frame structure into a predetermined position relative to the main frame structure; and

locking means coacting with said auxiliary frame structure for releasably locking the same to the main frame structure.

2. A coating device in accordance with claim 1 wherein said drive means comprise a cylinder-piston servo means, the cylinder of said means being mounted on said main frame structure and the piston of said servo means being drivingly coupled with said auxiliary frame structure for displacing the same relative to the main frame structure by activating the servo means.

3. A coating device in accordance with claim 1 wherein said locking means comprise coating clamping members on the main frame structure and the auxiliary frame structure for releasably clamping the auxiliary frame structure in a selected position to the main frame structure.

4. A coating device in accordance with claim 3 wherein said clamping means comprise on one of the frame structures cylinder-piston servo means and linkage means coupled to the piston for controlling the position thereof in the cylinder and on the other frame structure retention means engaged with the linkage means in a predetermined position of said piston.

5. An installation for coating bands in continous operation, said installation comprising in combination:

a plurality of coating devices as defined in claim 1;

a separate enclosure for each of said coating devices; and

an air purifying assembly for each of said enclosures, for removing pollutants released by the coating material and entrained in air, each of said assemblies comprising pump means, burner means for burning combustible pollutants entrained in air, drying means and conduits interconnecting each of said

enclosures with said pump means, said drying means and said burner means for forcing air flow sequentially through the respective enclosure, burner means and drying means thereby purifying the air and discharge means for discharging the purified air for the enclosures into the atmosphere.

6. An installation in accordance with claim 5 and comprising in each of said assemblies after-burner means interposed between said drying means and discharge means for discharging air into the atmosphere.

7. An installation in accordance with claim 5 wherein said enclosures are disposed in superimposition.

8. An installation in accordance with claim 7 wherein said conduits are disposed in mutually parallel relationship with and between the superimposed enclosures.

9. An installation in accordance with claim 7 and comprising heat-exchanger means for each of said assemblies, each of said heat-exchanger means being included in the respective conduits.

10. A coating device according to claim 1 and comprising second drive means for displacing said coating assembly relative to the auxiliary frame structure and thus relative to the selector roller.

11. A coating device according to claim 1 wherein said guide means on the auxiliary frame structure and on the main frame structure are linear guide means.

* * * * *

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United States Patent [19]

Preuss et al.

[11] **3,931,791**

[45] **Jan. 13, 1976**

[54] **MECHANISM FOR APPLYING LACQUERS AND THE LIKE ON A PRINTING PRESS**

[75] Inventors: **Friedrich Preuss**, Sprendlingen; **Kurt Difflipp**, Dietzenbach, both of Germany

[73] Assignee: **Roland Offsetmaschinenfabrik Faber & Schleicher AG**, Germany

[22] Filed: **Sept. 5, 1974**

[21] Appl. No.: **503,475**

[30] **Foreign Application Priority Data**

Sept. 7, 1973 Germany 2345183

[52] **U.S. Cl.** **118/236**; 118/249; 118/262

[51] **Int. Cl.**[2] **B05C 1/02**

[58] **Field of Search** 118/262, 46, 236, 239, 118/231, 249, 250; 101/350

[56] **References Cited**

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Primary Examiner—John P. McIntosh

Attorney, Agent, or Firm—Wolfe, Hubbard, Leydig, Voit & Osann, Ltd.

[57] **ABSTRACT**

Sheet coating means for a printing press including a back-up cylinder and form cylinder having an associated fountain, the fountain having a fountain roller rotating adjacent the form cylinder. Also rotating adjacent the form cylinder is a first form roller which is coupled to the fountain roller via a dosing roller. The fountain and its associated rollers are mounted upon a subframe having provision for (a) shifting the fountain roller into liquid transmitting contact with the form cylinder and (b) shifting the first form roller into liquid transmitting contact with the form cylinder thereby, selectively, to change the length of the liquid transference path from the fountain to a sheet carried by the back-up cylinder in accordance with the drying speed of the coating material. In a preferred embodiment the fountain assembly includes a second form roller rotating adjacent the back-up cylinder for transmitting coating material directly from the fountain roller to the sheet thereby bypassing the form cylinder, extending the capability to use with coating materials of a viscous nature. Also in a preferred embodiment the fountain roller is driven by means separate from the press drive thereby to control the rate of application.

5 Claims, 4 Drawing Figures

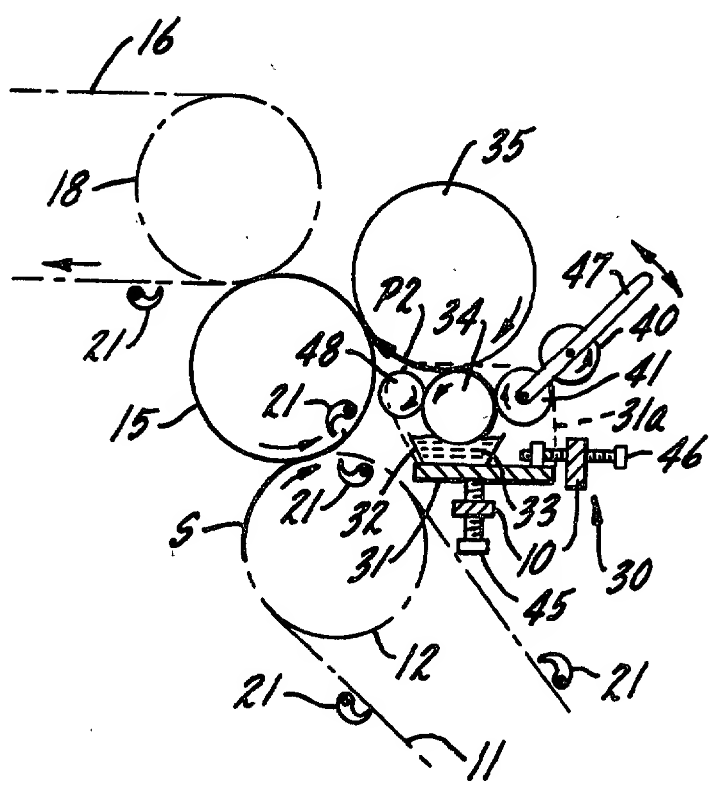


Fig.1.

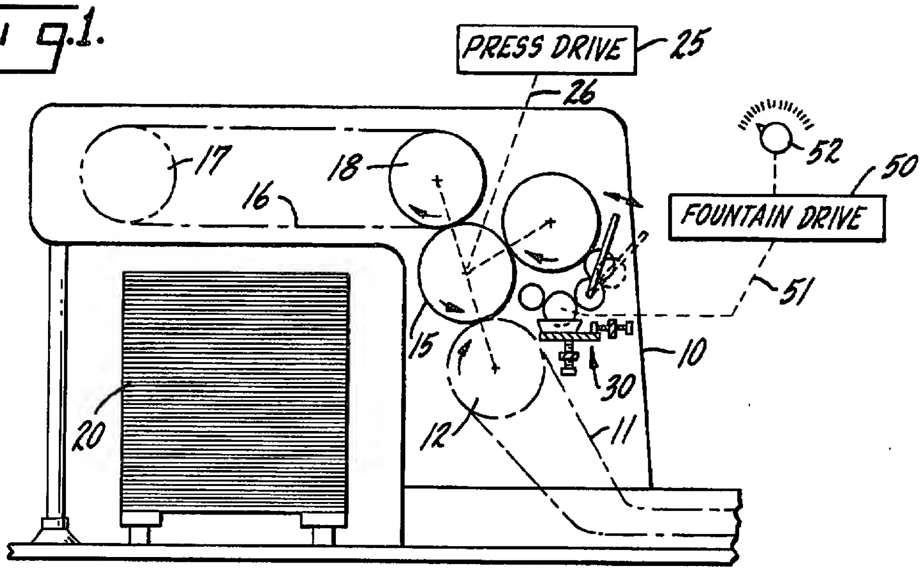
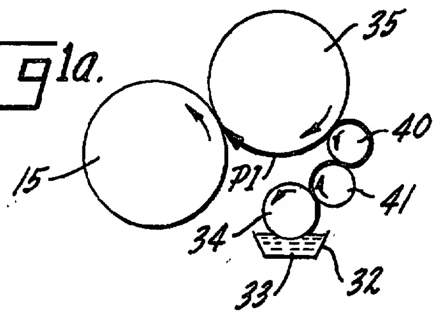


Fig.1a.



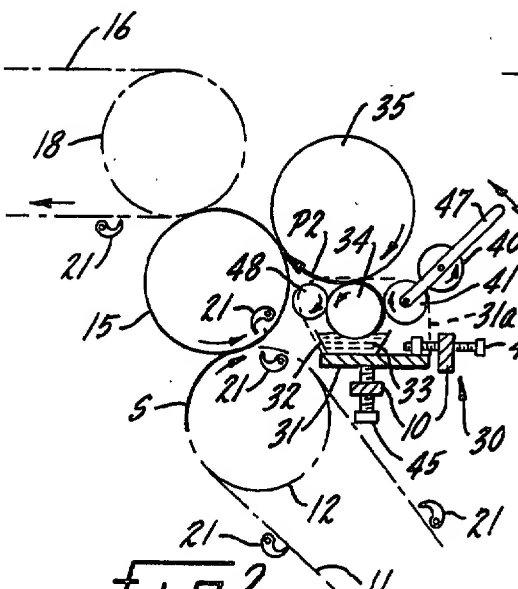


Fig.2.

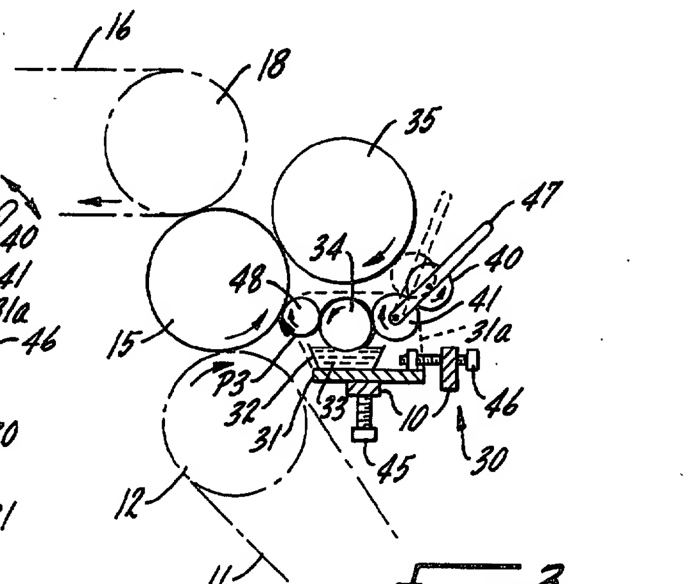


Fig.3.

MECHANISM FOR APPLYING LACQUERS AND THE LIKE ON A PRINTING PRESS

In a sheet fed printing press, particularly of the lithographic type, it is frequently desired to coat a sheet with a liquid coating material, such as a lacquer, after the sheet has been printed and just prior to depositing the sheet on a delivery pile. It is, of course, desirable that the coating material be evenly distributed and applied while it is still in liquid form, before it dries on the rolls. Conventional coating assemblies have been capable of applying relatively slow drying materials, but when employed with fast drying materials the operation has not been successful since the material tends to dry before reaching the sheet. Nor are conventional coaters capable of handling coating materials having a wide range of drying time or wide range of viscosity.

It is, accordingly, an object of the present invention to provide a coating arrangement for use in connection with a lithograph printing press which overcomes the disadvantages of prior coaters and which is highly flexible, being capable of coating with a wide variety of materials having different drying times and different viscosities but which is, nonetheless, simple and economical in construction.

Other objects and advantages of the invention will become apparent upon reading the attached detailed description and upon reference to the drawings in which:

FIG. 1 shows the delivery end of a lithographic printing press including a coating mechanism in accordance with the present invention;

FIG. 1*a* is a fragmentary diagram showing the fluid path in FIG. 1;

FIG. 2 is a diagram showing the arrangement of FIG. 1 in an alternate mode.

FIG. 3 is a similar diagram showing a still further operating mode.

While the invention has been described in connection with a preferred embodiment, it will be understood that we do not intend to be limited to the embodiment shown but intend, on the contrary, to cover the various alternative and equivalent constructions included within the spirit and scope of the appended claims.

Turning now to FIG. 1 there is shown the delivery end of a printing press having a frame **10** and to which sheets are individually delivered upon a chain type conveyor **11** in which the chains are trained about a pulley **12**. From the conveyor **11** sheets are individually passed to a back-up cylinder **15** and thence to a final chain type conveyor **16** having pulleys **17, 18**. From the conveyor **16** sheets are deposited in a pile **20**. The conveyor **11**, cylinder **15** and conveyor **16** have, for simplicity, been shown in diagrammatic form. It will be understood that each of these includes grippers, generally indicated at 21 (FIG. 2) for engaging the leading edge of a printed sheet together with means for synchronously operating the grippers to effect transfer of the sheet from conveyor **11** to cylinder **15**, and from cylinder **15** to conveyor **16**, from which the sheet is dropped onto the pile. Also for the sake of simplicity the press drive **25** and drive train **26** have been shown diagrammatically, with the understanding that both driving and sheet transfer, from conveyor to cylinder and vice versa, are well understood to those skilled in the art, cross reference being made to the patent literature for the details of construction.

For the purpose of coating a sheet (a typical sheet being indicated at S in FIG. 2) as it is transported on the back-up cylinder **15**, a fountain assembly **30** is provided including a subframe **31**. Mounted on the subframe is a fountain **32** having a body of liquid coating material **33**. Journaled in the subframe, for example, in side plates outlined at **31*a***, and with its lower surface projecting into the body of coating material, is a fountain roller **34** (see especially FIG. **2**). For receiving a film of the coating material from the fountain roller and for transmitting it to a sheet conveyed by the back-up cylinder **15**, a form cylinder is provided. Such form cylinder, indicated at **35**, is journaled in the press frame **10** and synchronously driven via the drive train **26**.

In accordance with the present invention the fountain roller **34** is equipped with a dosing roller and form roller which is engageable with the form cylinder to provide an alternate and longer path of liquid application. Thus we provide, in a position adjacent the form cylinder **35**, a form roller **40**. Interposed between the form roller **40** and the fountain roller **34**, to provide communication between them, is a dosing roller **41**. The form roller **40** and dosing roller **41** are both journaled for rotation in the subframe **31** and the subframe is so mounted and constructed, for shifting movement, that the fountain roller **34** and form roller **40** may be selectively engaged with the form cylinder **35**. To permit movement of the subframe **31** it is floatingly mounted with respect to the main frame **10**, with its position being determined by adjustable shifting means. In the illustrated embodiment shifting of the subframe **31** in the vertical direction is accomplished by an adjusting screw **45** while shifting in the horizontal direction is brought about by an adjusting screw **46**, both adjusting screws being threadedly related to the main frame **10**. It will be apparent that by unscrewing the adjusting screw **45** the level of the subframe **31** may be dropped to disengage the fountain roller **34** from the surface of the form cylinder **35**.

In carrying out the present invention the shifting means preferably includes means for shifting the form roller **40** toward and away from the surface of the form cylinder **35**, that is, in the direction of the arrows shown in FIG. **1**. To this end the subframe includes a pair of arms **47** (only one of which is shown) which may be pivoted about the axis of the dosing roller **41** and with suitable means (not shown) for holding the arms in a desired operating position.

By manipulation of the shifting means, alternate paths are provided for the costing liquid proportioned in accordance with drying time. Thus referring to FIGS. **1** and **1*a***, the form roller **40** is advanced into liquid transmitting contact with the surface of the form cylinder **35**, while the fountain roller **34** is retracted therefrom, to produce a liquid transference path **P1**. Such path is lengthy and suited to coating liquids having a relatively long drying time. Indeed, the path is sufficiently long so that volatile elements in the coating material are permitted to escape during the time that the coating material is formed into a smooth film by the action of the rollers **34, 41, 40** and cylinder **35**, against one another. Thus when the coating material is transferred onto the sheet at the end of the path **P1** it is still in liquid form but it is nonetheless preconditioned for drying after it is deposited upon the surface of the sheet so that the sheets do not stick together upon being deposited on the pile **20**.

Alternatively, the supporting arms 47 (FIG. 2) may be swung away from the form cylinder 35 to retract the form roller 40 from contact, and the adjusting screw 45 may be screwed in to raise the subframe 31 to engage the fountain roller 34 with the surface of the form cylinder thereby to create a short transference path indicated at P2. The path is sufficiently short so that the coating liquid from the fountain is almost immediately applied to the sheet on the back-up cylinder without opportunity for drying to take place on the form cylinder. The mode illustrated in FIG. 2 is, therefore, ideally suited for use with coating liquids having a short drying time.

It will be noted that the rollers, and cylinder 35, are compatible in both of the modes of operation. Assuming that the form cylinder 35 is resiliently surfaced, the form roller 34 may be hard surfaced and in slightly indenting relation to insure that a smooth film is transferred along the path P2. Further, the dosing roller 41 is resiliently surfaced, and the form roller 40, unlike most conventional form rollers, is hard surfaced, indenting both the dosing roller and form cylinder so that a similar film, in even thickness, is transferred along the path P1. Moreover, it will be noted that the directions of the rollers are, in both modes, completely compatible, with the dosing roller 41 not only preserving the "hard-soft" order of the rollers but causing movement of the form roller surfaace 40 to be in the same direction as the surface of fountain roller 34 as required for alternate engagement. Thus it is a feature of the invention that the direction of the fountain roller is preserved in all operating modes.

In accordance with the preferred embodiment of the present invention an auxiliary, or second, form roller 48 is provided mounted on the subframe 31, interposed between the fountain roller and the back-up cylinder, and selectively engageable with the surface of the latter, so that the coating material from the fountain may be applied directly to the sheet on the back-up cylinder, thus bypassing the surface of the form cylinder 35. Such mode of operation, illustrated in FIG. 3, is especially suited for use with coating materials of a viscous nature, for example, certain viscous varnishes. To achieve the mode of operation shown in FIG. 3 the adjusting screw 45 and arms 47 are retracted, and adjusting screw 46 is advanced to shift the fountain subframe 31 horizontally to bring roller 48 against the surface of the back-up cylinder 15. This provides a transference path P3 which may, depending upon the diameter of the roller 48, be somewhat shorter than the path P2 previously mentioned.

It may be noted that while the assembly of rollers and cylinders discussed above provides three distinct, alternative modes of operation, all of the components in the system are, nevertheless, at all times active. Thus in the mode illustrated in FIG. 1, in which transference occurs via rollers 41, 40, the roller 48, by its continued rotation, performs a smoothing function, and this is also true of the mode shown in FIG. 2. Similarly, while rollers 40 and 41 are inactive in the modes of FIGS. 2 and 3 as far as liquid transference is concerned, such rollers, by their continuous rotation, continue to provide a smoothing function, insuring that the film which is transferred along paths P2, P3 is of an even and consistent nature. Thus the coating means, in addition to accommodating different drying times and different viscosities, is eminently usable with liquids that are difficult to spread, in an even film, in coating devices of more conventional design.

In the above discussion it has been assumed that the fountain roller and associated rollers are rotated either as the result of surface friction or by providing a suitable and synchronized drive connection with drive train 26. However, it is one of the features of the present invention that the fountain roller 34 is provided with separate driving means diagrammatically indicated at 50 in FIG. 1 and which includes a fountain drive train 51 with the speed of the drive being capable of separate manual adjustment by means of an adjusting knob 52, reference being made to the art relating to controlled speed drives for the details of construction. By separate control of the speed of rotation of the fountain roller 34, the rate at which the coating liquid is drawn from the fountain and hence the thickness of application to the sheet is under the precise control of the operator, with the difference in surface speed being accommodated by slippage, for example, by slippage at the surface of the fountain roller.

In the exemplary embodiment it will be noted that two separate means have been discloosed for achieving movement of the rollers. Thus the rollers may be mounted for bodily shifting movement with a subframe, such as subframe 31, as in the case of roller 34, or the rollers may be mounted for individual shifting, or swinging movement, as in the case of the roll 40 which is swingable on arms 47. If desired, the second form roller 48 may be swingably mounted in the same way as roller 40 for individual movement into and out of engagement with the back-up cylinder. Also if desired the form roller 34 may be individually mounted for movement vertically from the directly transferring position shown in FIG. 2 downwardly, accompanied by deeper submergence into the fountain, into the position shown in FIG. 3. The term "means for shifting the subframe" as used herein therefore includes the relative shifting of rollers with respect to the subframe. Selection of length of path "in accordance with drying speed" shall mean that a long path corresponds to a relatively slow drying speed and vice-versa.

While adjusting screws have been shown simply to illustrate the principle of operation, one skilled in the art will appreciate that in practice throw-over cams or eccentrics may be substituted to simplify shifting between precise alternate positions. The term fountain includes generally means for furnishing liquid to a fountain roller.

What is claimed is:

1. For use with a sheet-fed printing press, means for applying a liquid coating material to a sheet following the printing thereof which comprises a main frame, a back-up cylinder journaled in the main frame, means including grippers for transferring a sheet to the back-up cylinder for transport thereon and for removing the sheet therefrom for delivery, a form cylinder journaled in the main frame in rolling engagement with the back-up cylinder, means for driving the cylinders and gripper means in unison, a fountain assembly including a fountain for the coating material, a fountain roller rotating therein adjacent the form cylinder, a first form roller adjacent the form cylinder, a dosing roller communicatingly interposed between the fountain roller and the first form roller, and a second form roller interposed between the fountain roller and the back-up cylinder, and means for selectively shifting the fountain roller and form rollers with respect to the main frame to (a)

bring the fountain roller into exclusive liquid transmitting contact with the form cylinder, to (b) bring the first form roller into exclusive liquid transmitting contact with the form cylinder and to (c) bring the second form roller into exclusive liquid transmitting contact with the back-up cylinder thereby to change the length of the liquid transference path from the fountain to the sheet in accordance with the drying speed of the coating material and to insure evenly distributed liquid application of the coating material to the sheet.

2. For use with a sheet-fed printing press, means for applying a liquid coating material to a sheet following the printing thereof which comprises a main frame, a back-up cylinder journaled in the main frame, means including grippers for transferring a sheet to the back-up cylinder for transport thereon and for removing a sheet therefrom for delivery, a form cylinder journaled in the main frame in rolling engagement with the back-up cylinder, means for driving the cylinders and gripper means in unison, a fountain assembly having a sub-frame mounted on the main frame and shiftable with respect to it, the fountain assembly including a fountain for the coating material, a fountain roller rotating therein adjacent the form cylinder, a form roller adjacent the form cylinder, a dosing roller communicatingly interposed between the fountain roller and the form roller, and means for selectively shifting the sub-frame with respect to the main frame into alternative conditions to (a) bring the fountain roller into exclusive liquid transmitting contact with the form cylinder and to (b) bring the form roller into exclusive liquid transmitting contact with the form cylinder thereby to change the length of the liquid transference path from the fountain to the sheet in accordance with the drying speed of the coating material to insure evenly distributed liquid application of the coating material to the sheet.

3. The combination as claimed in claim **2** in which a separate drive independent of the press drive is provided for the fountain roller.

4. The combination as claimed in claim **3** in which the drive is provided with speed adjusting means permitting a surface speed lower than press speed for controlling the rate at which the liquid coating material is fed from the fountain.

5. For use with a sheet-fed printing press, means for applying a liquid coating material to a sheet following the printing thereof which comprises a main frame, a back-up cylinder journaled in the main frame, means including grippers for transferring a sheet to the back-up cylinder for transport thereon and for removing the sheet therefrom for delivery, a form cylinder journaled in the main frame in rolling engagement with the back-up cylinder, means for driving the cylinders and gripper means in unison, a fountain assembly including a fountain for the coating material, a fountain roller rotating therein adjacent the form cylinder, a first form roller adjacent the form cylinder, a dosing roller communicatingly interposed between the fountain roller and the first form roller, and a seccond form roller interposed between the fountain roller and the back-up cylinder, and means for selectively shifting the fountain roller and form rollers with respect to the main frame to (a) bring the fountain roller into exclusive liquid transmitting contact with the form cylinder, to (b) bring the first form roller into exclusive liquid transmitting contact with the form cylinder and to (c) bring the second form roller into exclusive liquid transmitting contact with the back-up cylinder thereby to change the length of the liquid transference path from the fountain to the sheet in accordance with the drying speed of the coating material and to insure evenly distributed liquid application of the coating material to the sheet, the rollers being surfaced to produce an alternating hard-soft liquid transfer sequence and the cylinders being driven without reversal of direction during all three exclusive liquid transmitting modes.

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UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 4,222,325
DATED : September 16, 1980
INVENTOR(S) : Robert Edwards

It is certified that error appears in the above—identified patent and that said Letters Patent is hereby corrected as shown below:

Column 2, Line 15, (2d line of Fig. 5) - "linking" should be -- inking --.

Column 5, Line 34, under caption "Detailed Description of the Preferred Embodiment" - "is" should be -- in --.

Column 7, Line 32, after the word "rail" "20" should read -- 120 --.

Column 10, Line 9, after the word "invention" "with" should read -- which --.

Column 11, Line 44, - "26" should read -- 36 --.

Column 12, Line 6, - "30" should read -- 20 --.

Column 12, Line 13, - "30" should read -- 20 --.

Signed and Sealed this

Eighteenth Day of *November 1980*

[SEAL]

Attest:

SIDNEY A. DIAMOND

Attesting Officer *Commissioner of Patents and Trademarks*

United States Patent [19]

Edwards

[11] **4,222,325**

[45] **Sep. 16, 1980**

[54] **MOUNTING MEANS FOR MOVABLE CARRIAGE ON AN OFFSET PRESS**

[75] Inventor: **Robert Edwards**, Dudley, Mass.

[73] Assignee: **White Consolidated Industries, Inc.**, Cleveland, Ohio

[21] Appl. No.: **936,826**

[22] Filed: **Aug. 25, 1978**

[51] **Int. Cl.**[3] **B41F 7/08**; B41F 7/40; B41F 31/34

[52] **U.S. Cl.** **101/137**; 101/148; 101/177; 101/185; 101/247; 101/351; 101/248

[58] **Field of Search** 101/177, 183, 184, 185, 101/136, 137, 140, 141, 142, 143, 144, 145, 247, 209, 351, 352, 178, 182, 138, 139, 179, 180, 181, 148

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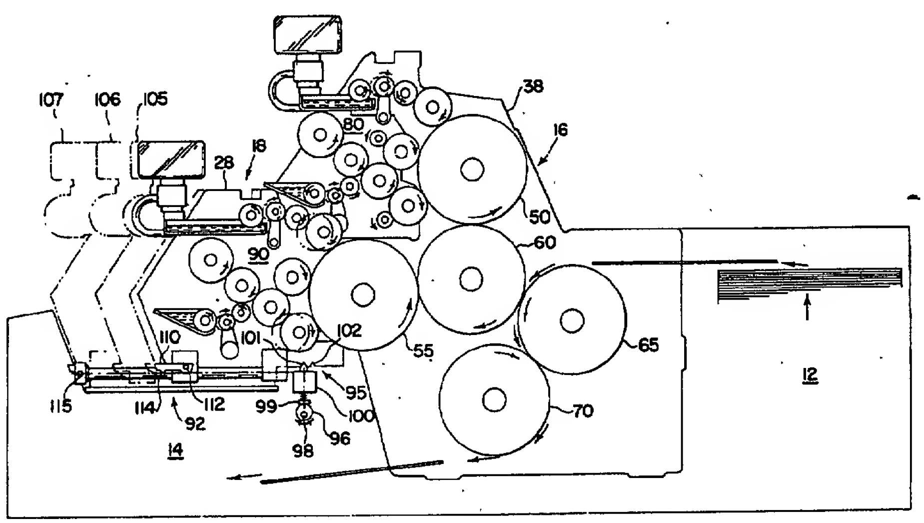
Primary Examiner—J. Reed Fisher
Attorney, Agent, or Firm—Pearne Gordon Sessions

[57] **ABSTRACT**

A two-color offset printing press having two plate cylinders simultaneously engageable with a single blanket cylinder is disclosed. The plate cylinders and a blanket cylinder are rotatably mounted on a printer head fixed to the mainframe of the press. A first set of dampening and inking rollers is mounted on the printer head and engageable with one of the plate cylinders. A second set of dampening and inking rollers, engageable with the other plate cylinder, is mounted on a ball bushing supported carriage linearly movable to and from the printer head along a pair of parallel rails fixed to the mainframe. Image registry between the two plate cylinders is established by an operator-accessible adjustment mechanism for shifting one of the plate cylinders back and forth along its axis of rotation. An electrical safety interlock system precludes operator access to the carriage-associated plate cylinder during predetermined operating modes of the press.

2 Claims, 13 Drawing Figures



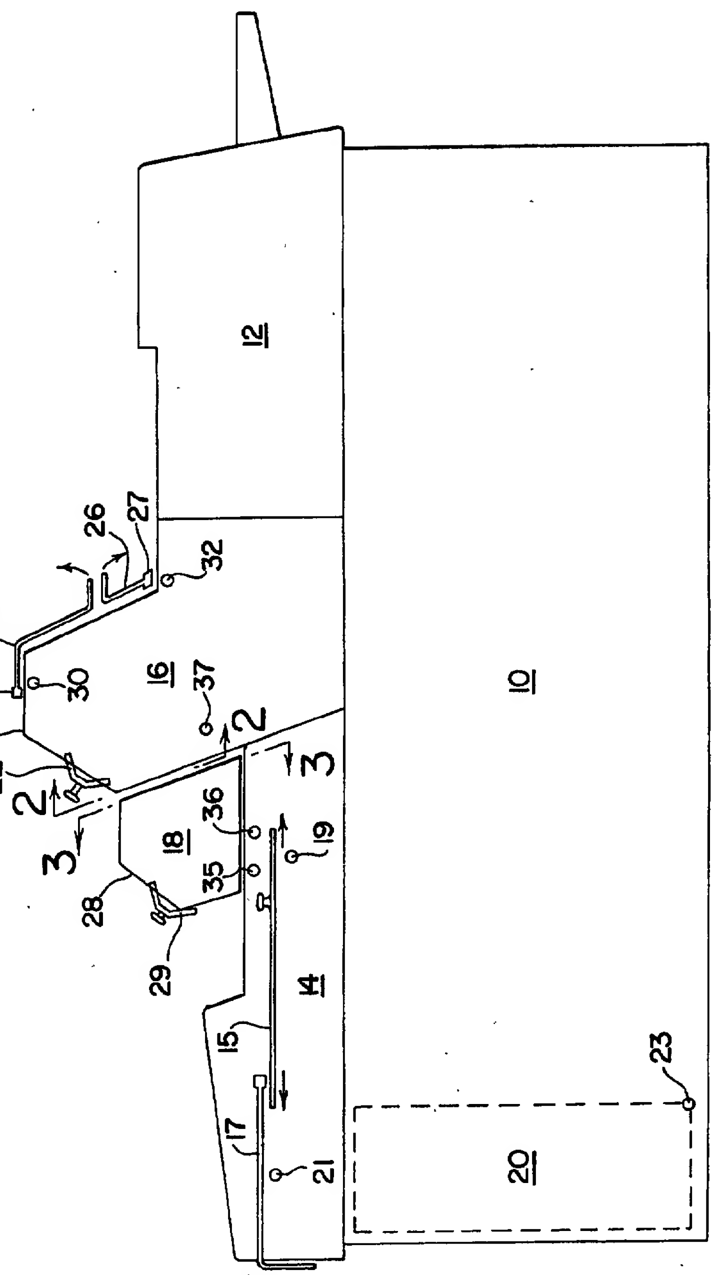


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FIG. 1

FIG. 3

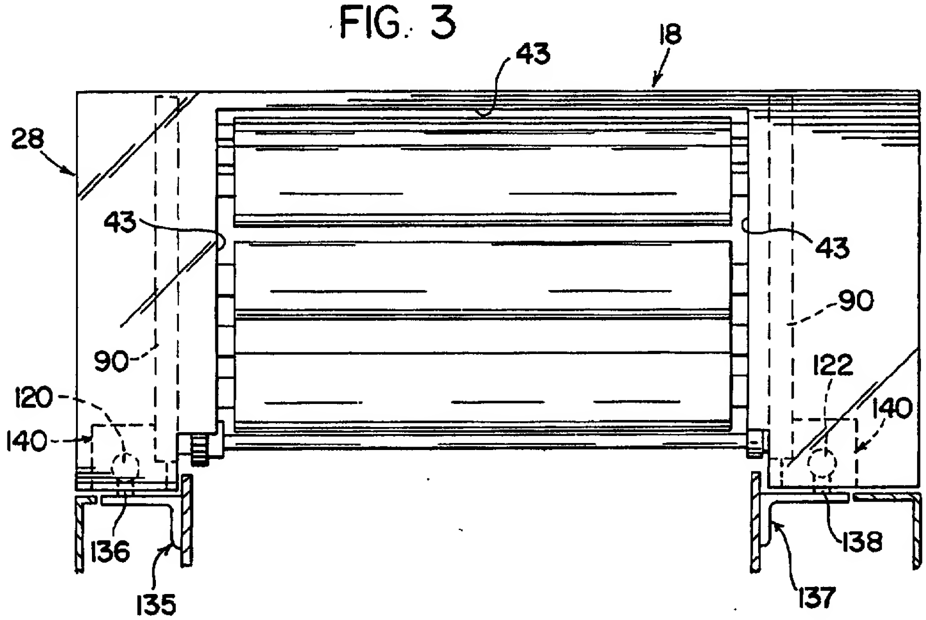


FIG. 2

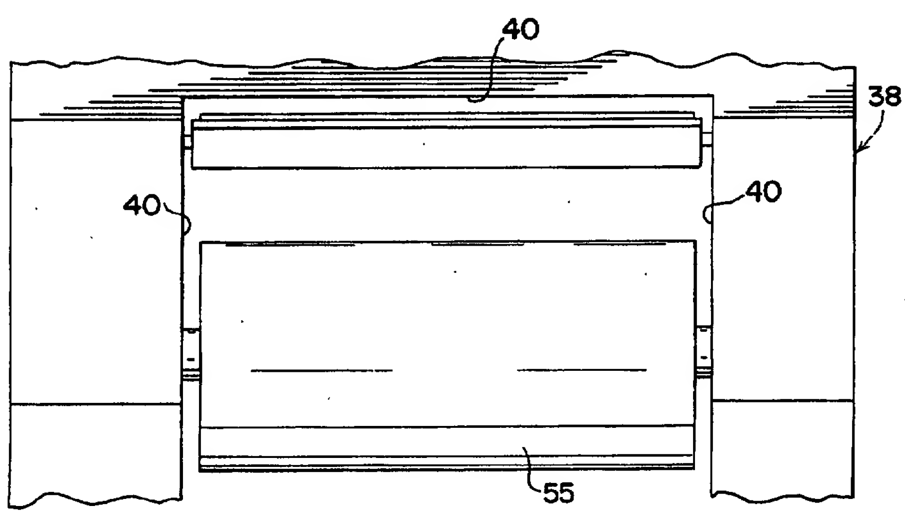
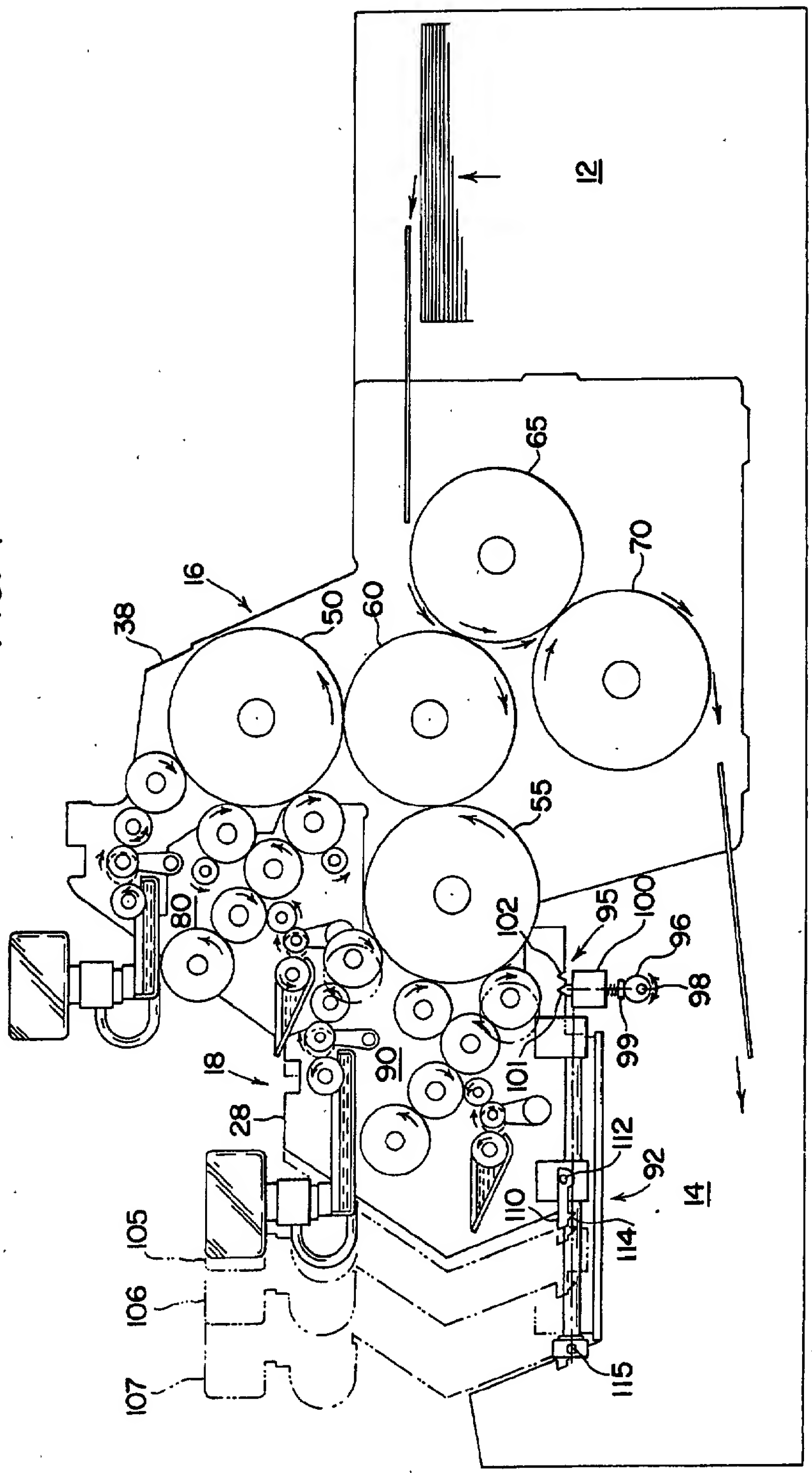


FIG. 4


12
16
38
50
60
65
70
55
80
90
18
28
95
100
102
96
98
99
101
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92
14
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114
115
105
106
107

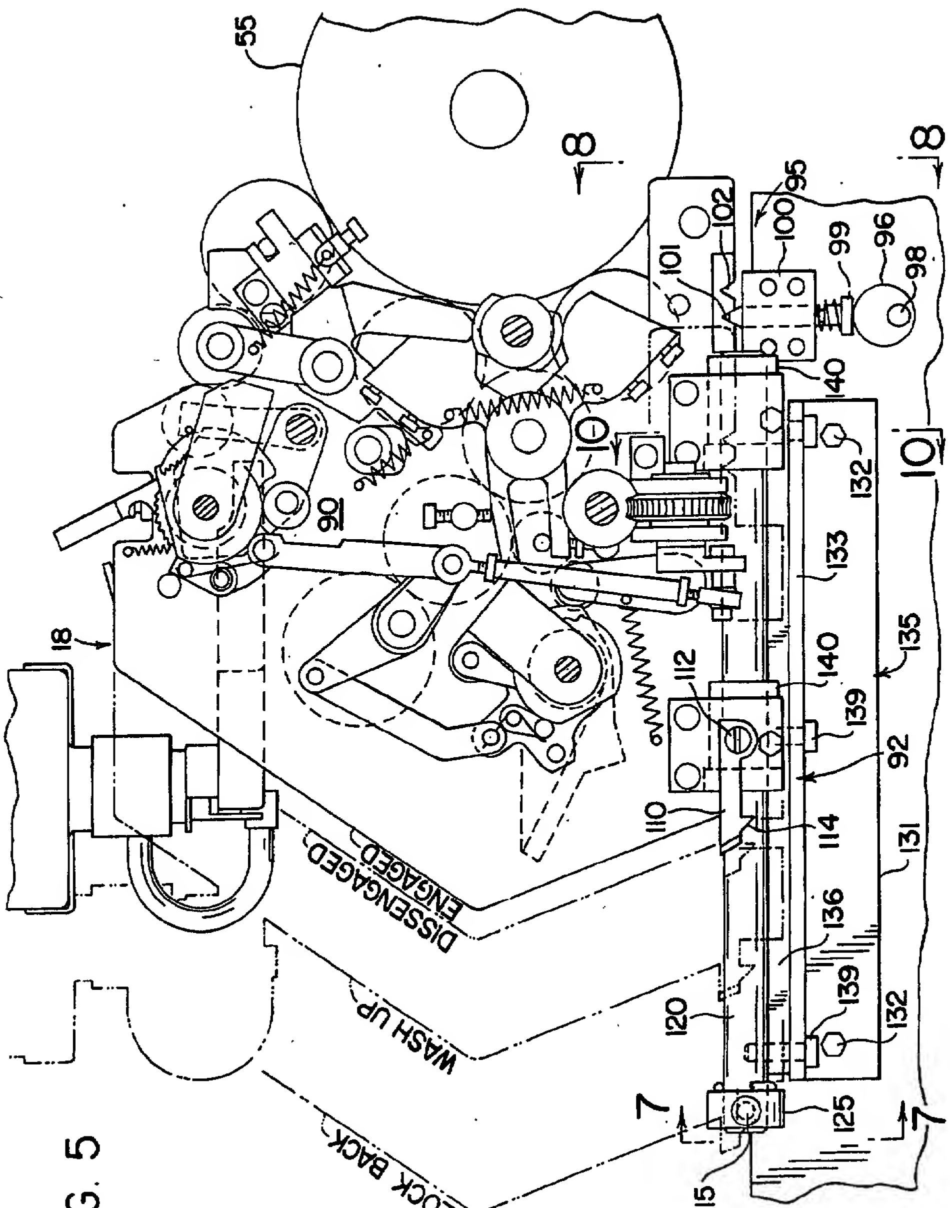


FIG. 5

FIG. 7

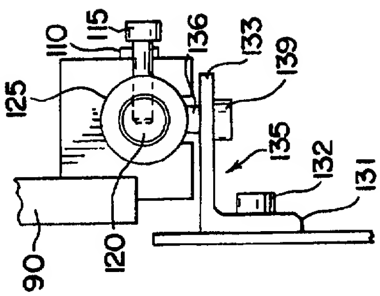

110
115
136
133
139
125
135
132
131
120
90

FIG. 6

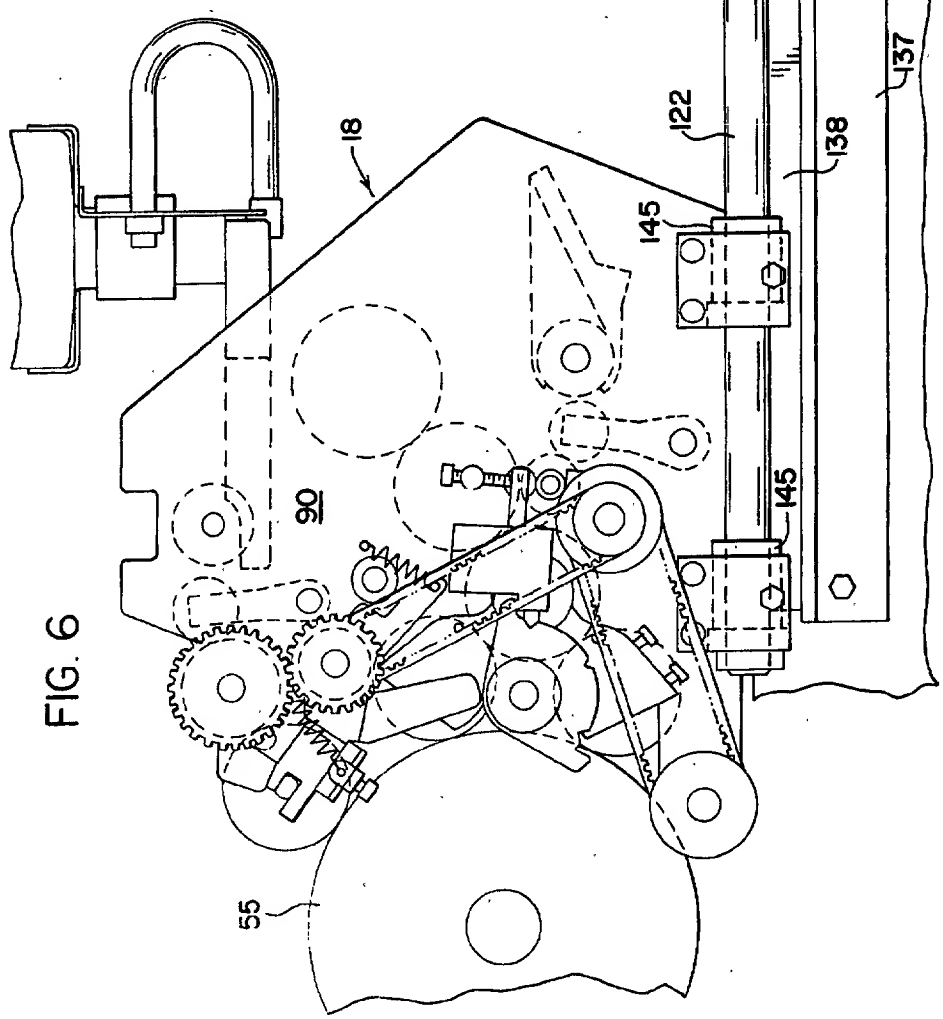
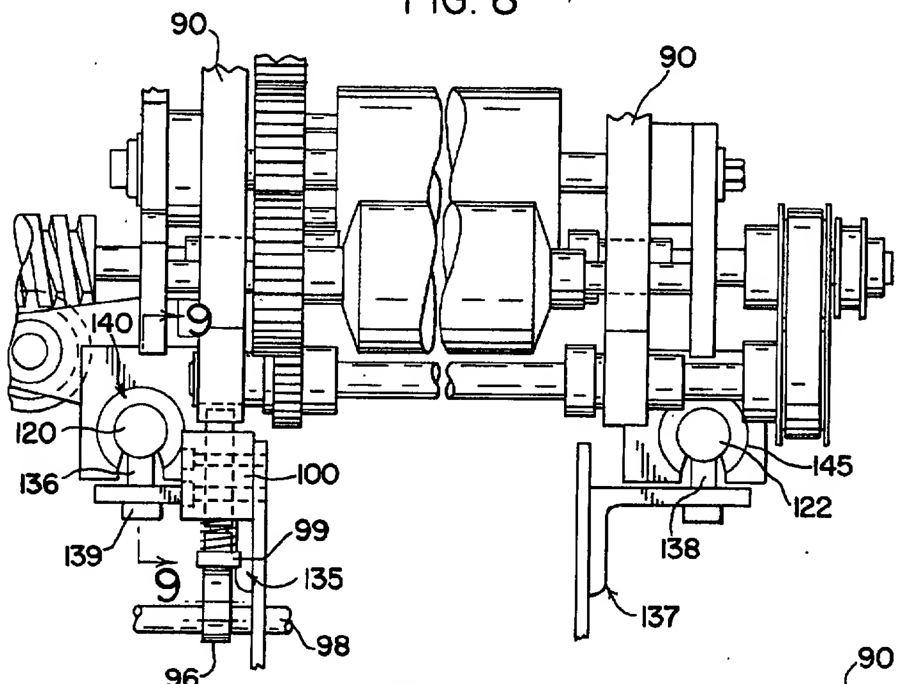

126
18
122
137
138
145
145
90
55

FIG. 8



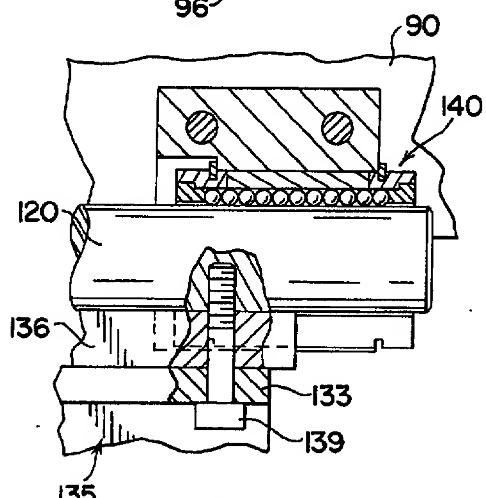


FIG. 9

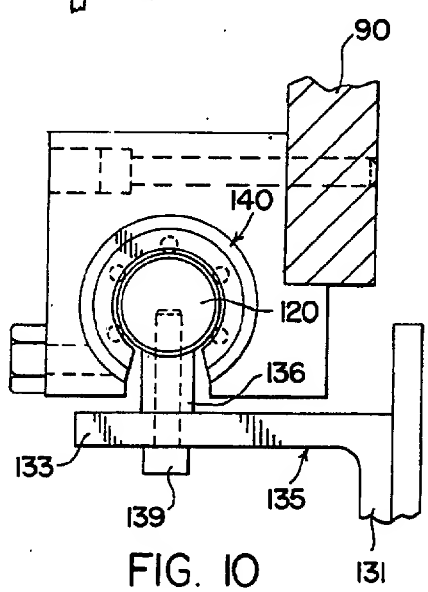
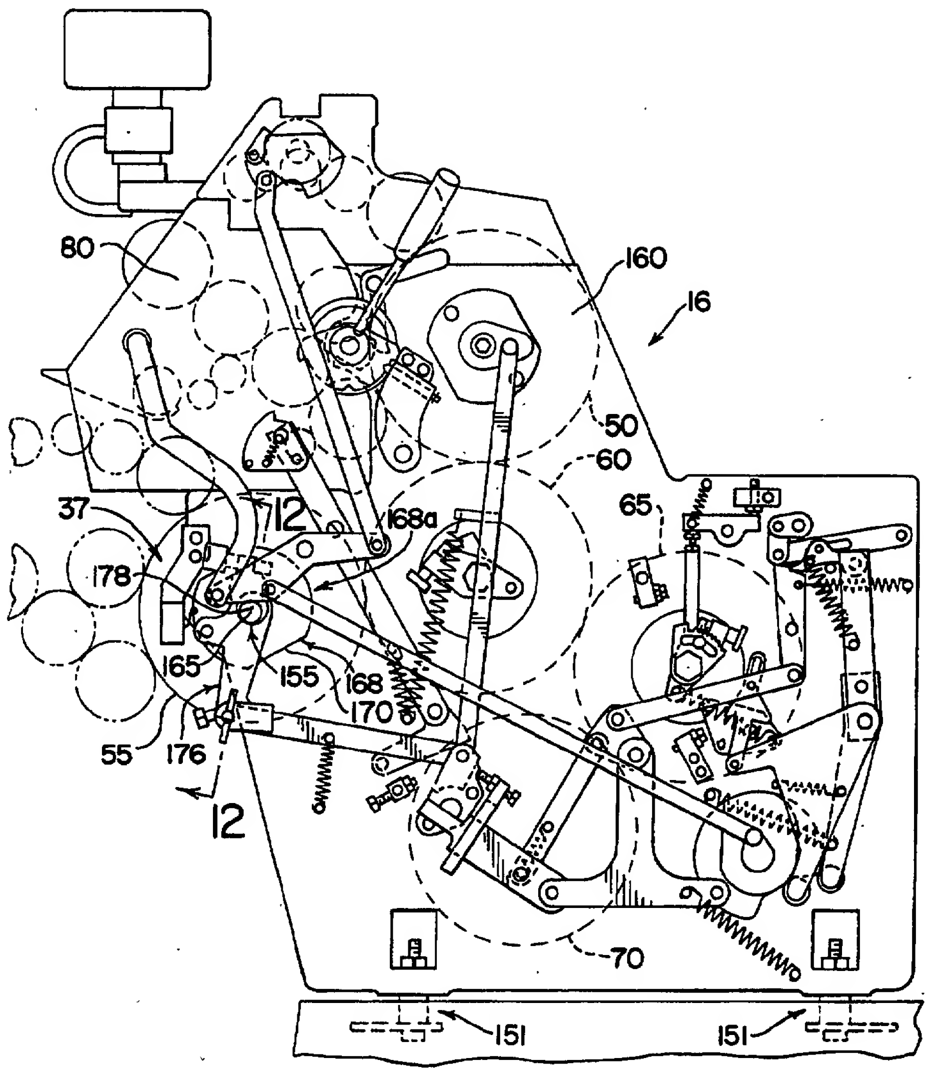
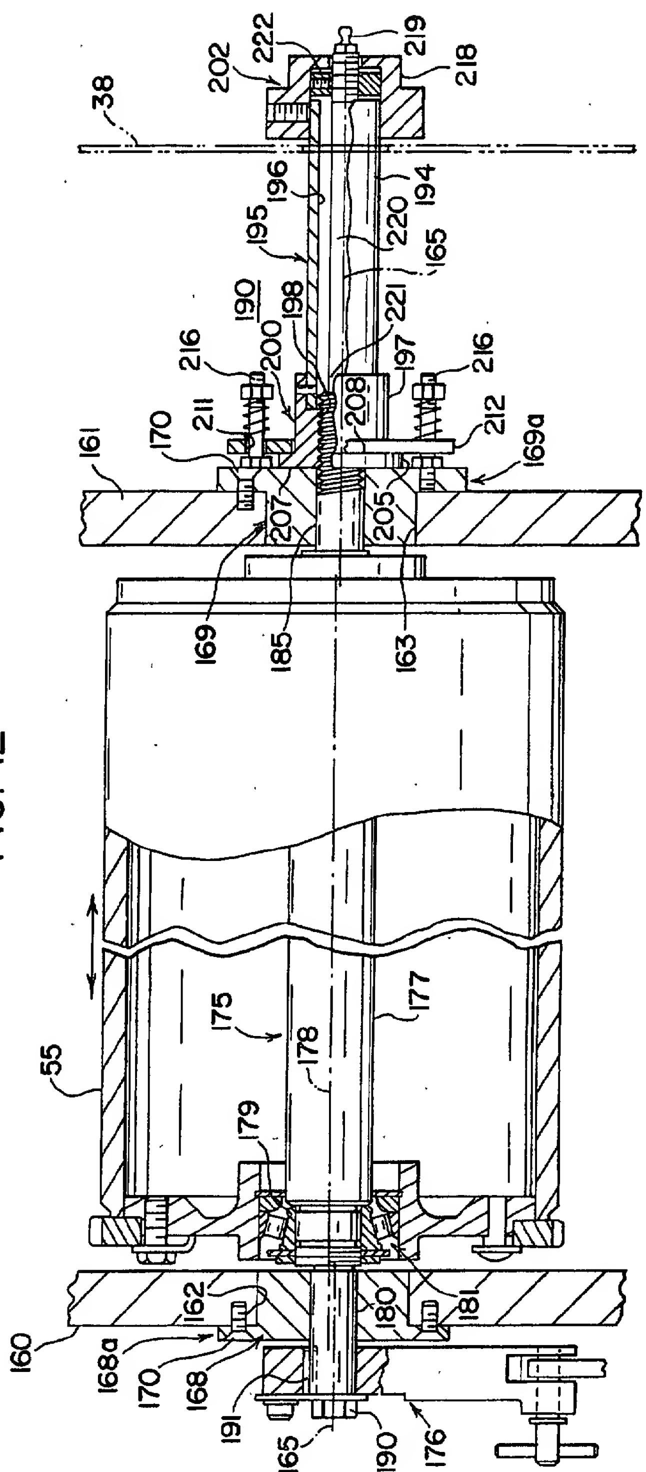


FIG. 10



80
160
16
50
60
65
37
12
168a
178
165
155
168
170
55
176
12
70
151
151

FIG. 11



38
202
222
219
218
196
194
195
220
165
190
198
221
200
197
216
208
211
212
170
169a
161
207
205
169
185
163
177
175
178
55
179
162
180
181
160
168a
168
191
176

FIG. 12

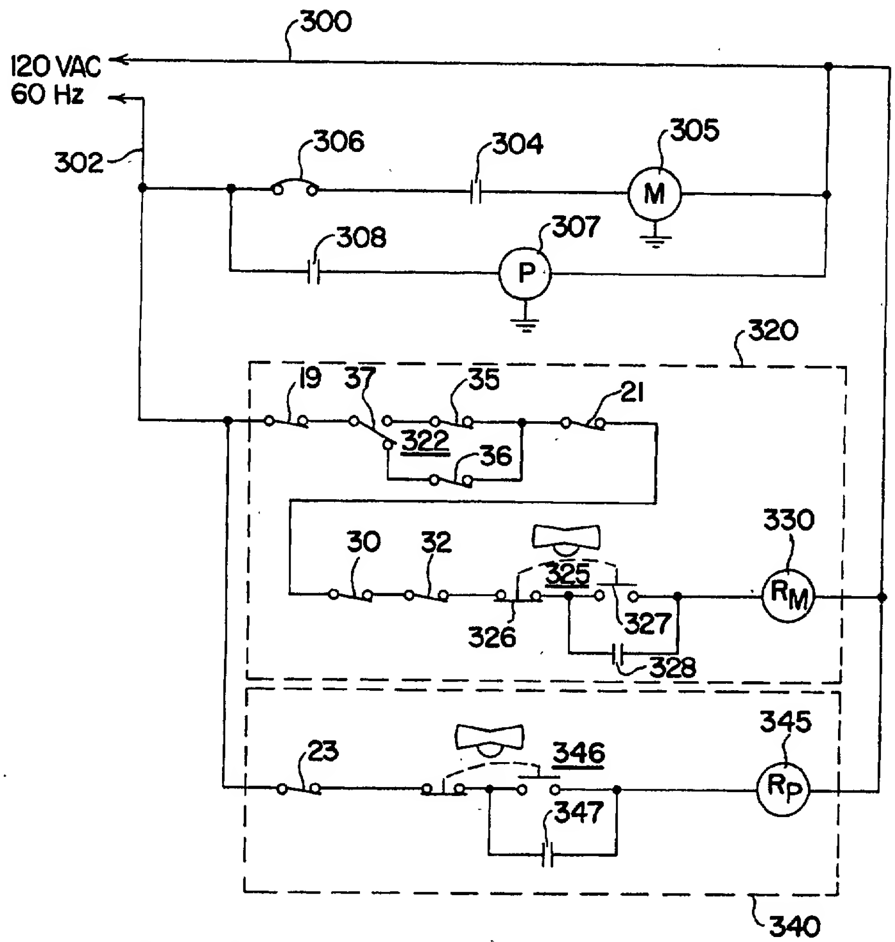

300
120 VAC
60 Hz
302
306
304
305
M
308
307
P
320
19
37
35
21
322
36
30
32
325
330
RM
326
327
328
345
23
346
RP
347
340

FIG. 13

MOUNTING MEANS FOR MOVABLE CARRIAGE ON AN OFFSET PRESS

BACKGROUND OF THE INVENTION

This invention relates to offset printing, and in particular to an offset printing press having a dampening and inking roller-containing carriage linearly movable to and from an associated plate cylinder.

The set of dampening and inking rollers on the carriage, when moved to an engagement position with a respective plate cylinder, must be properly positioned relative to the plate cylinder to provide controlled amounts of inking and dampening fluid to the plate cylinder. To provide such proper positioning, it is necessary that lateral and skewing movements of the linearly movable carriage be eliminated.

The prior art, as represented by U.S. Pat. No. 3,521,559 to Sejeck et al., is intended to provide proper positioning of a linearly movable ink roller-containing carriage relative to its respective plate cylinder by the use of interlocking abutting slide members of wear-resistant, low friction, synthetic resin. The slide members are intended to preclude lateral shifting or skewing of the carriage to provide for proper positioning of the carriage-contained ink rollers relative to their respective plate cylinder. Such a slide arrangement is further intended to give all the benefits of a more expensive machined dovetail slide arrangement.

While the Sejeck et al. slide arrangement may represent a cost improvement over a conventional dovetail type slide, such a slide arrangement would still be susceptible to surface-to-surface sliding friction wear as is a dovetail-type slide. Further, the weight of the moving carriage may have to be limited to prevent degeneration of the relatively soft synthetic resin material used to form the Sejeck et al. carriage-supporting slide members.

SUMMARY OF THE INVENTION

In accordance with the present invention, a printer head, including at least one rotatably mounted blanket cylinder and at least one rotatably mounted plate cylinder engageable with the blanket cylinder, is mounted on and fixed to a mainframe which supports a dampening and inking roller-containing carriage linearly movable to and from the printer head on a set of rolling-friction bearing surfaces. The carriage is positively lockable at predetermined locations lying along its linear path of movement to and from the printer head. In a preferred form the invention includes a plurality of linear motion ball bushings fixed to the carriage. The bushings in turn ride on a pair of mainframe-supported circular cross section rails that are parallel to and lie along either side of an axis normal to the axis of rotation of the plate cylinder which engages the set of dampening and inking rollers on the movable carriage when it is in an engagement position closest to the printer head.

The invention provides accurate linear movement of the carriage relative to its associated plate cylinder without lateral or skewing movements of the carriage, such positive linear motion precluding misalignment of the plate cylinder and its carriage-mounted set of dampening and inking rollers. Linear carriage movement is provided by the present invention at a relatively low cost and with high reliability. The rolling friction bearing surfaces provided by the preferred linear motion ball bushings in accordance with the invention advantageously provide extremely low friction movement of the carriage as opposed to the higher surface-to-surface friction slide mechanism of the prior art.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic elevation view from the operator's side of a two-color offset printing press, with covers in place, in accordance with the present invention;

FIG. 2 is an elevation view of the printer head of the press taken along line 2—2 of FIG. 1;

FIG. 3 is an elevation view of the movable carriage of the press taken along line 3—3 of FIG. 1;

FIG. 4 is a schematic elevation view from the operator's side of the press, with covers removed;

FIG. 5 is an operator's side, elevation view of the movable linking and dampening roller-containing carriage illustrating various carriage positions;

FIG. 6 is a nonoperator's side, elevation view of the movable inking and dampening roller-containing carriage supported by linear motion ball bushings;

FIG. 7 is an end view of a portion of the carriage mounting means taken along line 7—7 of FIG. 5;

FIG. 8 is an end view of the press carriage, with portions cut away, taken along line 10—10 of FIG. 5;

FIG. 9 is a longitudinal, cross section view of one of the ball bushing mountings of the carriage taken along line 9—9 of FIG. 8;

FIG. 10 is a transverse, cross section view of one of the ball bushing mountings of the carriage taken along line 10—10 of FIG. 5;

FIG. 11 is an operator's side, elevation view of the printer head of the press;

FIG. 12 is a longitudinal cross section view of the axially adjustable plate cylinder taken along line 12—12 of FIG. 11; and

FIG. 13 is a schematic diagram of the printing press safety interlock system.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to FIG. 1, there is schematically illustrated in elevation a two-color offset printing press in accordance with the present invention wherein a mainframe **10** having a paper feed input **12** and a paper delivery output **14**, supports a fixed printer head **16** and a carriage **18** linearly movable to and from the printer head **16**.

The printer head **16** includes a pair of plate cylinders engageable with a blanket cylinder, in turn engageable with an impression cylinder, in turn engageable with a delivery cylinder. The printer head **16** further includes a first set of dampening and inking rollers engageable with one of the plate cylinders.

The movable carriage includes a second set of dampening and inking rollers engageable with the other plate cylinder mounted on the printer head.

The detailed structure of the printer head **16** and carriage **18** will be illustrated and discussed subsequently.

By way of example, and with further reference to FIG. **1**, in a typical offset printing operation, blank printing paper in a stream of sequentially fed separate sheets, is provided by the paper feed input **12** to the printer head **16** wherein the paper passes between the image-containing blanket cylinder and an impression cylinder, the image on the blanket cylinder being transferred in a well-known manner to the paper. The

printed paper is then transferred via the paper delivery output 14 from the printer head 16 into a conventional vertically extending sheet stacking bin 20. The feeding of the printing paper to the printer head 16 by the paper feed input 12 and the delivery of the printed paper from the printer head 16 to the bin 20 by the paper delivery output 14 are provided by conventional chain transport systems well-known in the art.

To ensure safe operation of the press of the present invention, a plurality of fixed and movable covers are provided to limit operator access to moving parts of the press. The printer head 16 includes a cover 22 and two cooperating plate cylinder covers 24, 26, as shown in FIG. 1. The covers 22, 24, 26 serve to close printer head access openings used for maintenance or set-up of the press in a non-running condition. The plate cylinder covers 24, 26 are each pivotal about respective hinge joints 25, 27 fixed relative to the printer head 16. Associated with the covers 24, 26 are respective interlock switch means 30, 32 which are responsive to movement of their respective associated covers 24, 26 wherein opening and closing of the covers 24, 26 actuate the interlock switches 30, 32. In a manner to be subsequently explained in detail, opening of the covers 24, 26 by moving either of them pivotally away from the printer head 16 actuates the respective interlock switches 30, 32, which in turn deenergize the press drive motor to preclude operator access to moving press parts such as rotating cylinders and rollers mounted on and within the printer head 16. The cover 22 and movable covers 24, 26 cooperate with a printer head housing 38 to generally enclose the cylinder and rollers within the interior volume generally defined by the printer head housing 38.

The paper delivery output 14 includes a linearly slidable cover 15 and a cooperating pivotal cover 17, which limits operator access to the paper delivery chain drive when the paper delivery covers 15, 17 are in their closed position as illustrated in FIG. 1. Associated with the covers 15, 17 are respective interlock switch means 19, 21 which function to deenergize the press motor when the respective covers are in an open position as opposed to their closed illustrated positions. A bin overload interlock switch means 23 functions to deenergize the paper feed process when the bin 20 is full.

The carriage 18 includes a housing 28 and a cover 29 which generally encloses the interior mechanism of the dampening and inking roller-containing carriage 18, such mechanism to be explained subsequently in detail. Two carriage-related interlock switches 35, 36 are responsive to linear movement of the carriage 18 away from and toward the printer head 16. The carriage-related interlock switches 35 and 36 cooperate with a plate cylinder interlock switch means 37, the switching means 37 being responsive to the movement of a carriage-associated, printer head-mounted, plate cylinder into and out of an engaged position with the printer head-mounted blanket cylinder. The cooperating switch means 35, 36, 37 function together to limit operator access to moving parts within the printer head housing 38 and the carriage housing 28 when the carriage 18 is pulled back away from the printer head 16.

The heretofore discussed switch means are preferably in the form of mechanical microswitches, although other types of switches, such as optical coupler-type relays, are clearly applicable. The precise manner in which the above-noted plurality of interlocking switching means cooperate to deenergize the press motor to preclude unsafe operation of the press will be subsequently explained in detail.

With reference to FIG. 2 taken along line 2—2 of FIG. 1, it can be seen that the printer head housing 38 provides an edge wall 40 which circumscribes and defines a rectangular aperture for operator access to the interior of the housing 38 containing the printer head-mounted cylinders and rollers.

With reference to FIG. 3 taken along line 3—3 of FIG. 1, it can be seen that the carriage housing 28 has an edge wall 43 which circumscribes and defines a rectangular aperture for access to the interior of the dampening and inking roller-containing carriage housing 28.

When the carriage 18 is pulled back or withdrawn away from the printer head 16 to a prescribed degree, operator access to both the interior of the carriage housing 28 and the interior of the printer head housing 38 is provided via the noted rectangular apertures. When the carriage 18 is moved to a position closest to the printer head 16, the housing edge walls 40, 43 abut in opposing relation (FIG. 1) to limit operator access to the interior of the housings 28 and 38 wherein the housings cooperate with each other and with the earlier-noted covers 22, 24, 26, 29 to generally enclose the cylinder and roller mechanisms of the printer head 16 and carriage 18, respectively.

Turning to FIG. 4, there is illustrated, in accordance with the invention and in a more detailed manner, the printer head 16 and the carriage 18, which are generally enclosed by their respective housings 28, 38, schematically represented in outline fashion. The printer head 16 includes a first plate cylinder 50, a second plate cylinder 55, a blanket cylinder 60, an impression cylinder 65, and a delivery cylinder 70.

The plate cylinders 50, 55, the blanket cylinder 60, the impression cylinder 65, and the delivery cylinder 70 are interengageable and rotatably mounted on the printer head 16. Each of the cylinders 50, 55, 60, 65, 70 lies along parallel axes of rotation with their outer surfaces of revolution in generally opposed, abutting relationship, as illustrated. Associated with and mounted on and fixed to the printer head 16 is a first set of dampening and inking rollers 80 rotatable on axes of rotation parallel to the axes of rotation of the printer head cylinders. The set of dampening and inking rollers 80 is conventional and functions to provide the first plate cylinder 50 with dampening and inking fluid in a well-known manner.

Associated with and mounted on and fixed to the movable carriage 18 is a second set of conventional dampening and inking rollers 90 located along axes parallel to those of the printer head cylinders. The second set of dampening and inking rollers functions to provide the second plate cylinder 55 with dampening and inking fluids as illustrated.

In a two-color printing operation, the carriage 18 is moved to an engagement position closest to the printer head 16, as illustrated in FIG. 4, wherein the second set of dampening and inking rollers 90 contacts the second plate cylinder 55, as illustrated, via the apertures defined by the carriage and printer head housing edgewalls 40,43 (See FIGS. 2 and 3). The first set of dampening and inking rollers 80 contacts the first plate cylinder 50.

In operation, the plate cylinders 50, 55 each contain, in wraparound fashion, a single-color image-carrying plate which is inked and dampened in a conventional manner by the sets of dampening and inking rollers 80,

90, the directions of cylinder and roller rotation being indicated in FIG. 4. Images from the plate cylinders 50, 55 are simultaneously transferred and superimposed in proper registry upon the blanket cylinder 60. The superimposed images on the blanket cylinder 60 are then simultaneously transferred to the blank printing paper fed between the blanket cylinder 60 and the impression cylinder 65. The printed paper is then stripped from the impression cylinder 65 by the delivery cylinder 70. The movement of the paper between the paper feed input 12 and the paper delivery output 14 defines a sinuous paper handling path extending therebetween, as illustrated in FIG. 4.

The process of printing on paper with two single-color plate cylinders cooperating with a blanket cylinder, which in turn cooperate with respective impression and delivery cylinders, is known in the art, as is a paper handling means generally illustrated in FIG. 4.

In accordance with the invention, the second plate cylinder 55 is rotatably mounted and fixed to the printer head 16, while its associated set of dampening and inking rollers 90 is mounted on and fixed to the movable carriage 18. The carriage 18 is preferably linearly movable to and from the second plate cylinder 55 in a manner to be subsequently explained and lockable at a predetermined number of positions along its travel length by means, of, for example, a detent mechanism 95 or a simple latch mechanism 92.

As illustrated in FIG. 4, the carriage is in an engagement position for a typical two-color offset printing operation as earlier discussed. In accordance with the invention, it can be seen that the detent mechanism 95 as shown in FIG. 4 locks the carriage 18 at the engagement position. The positive locking of the carriage is position by the detent mechanism 95 is accomplished by rotating an eccentrically mounted, vertically extending cam member 96 about a pivot pin 98. Rideable upon the outer upper edge of the cam member 96 is a spring-biased pin 99 which reciprocates to and from the carriage 18 upon a predetermined degree of rotation of the cam member 96. With the cam member 96 in a locking position as illustrated in FIG. 4, the pin 99, slidable upward through a collar 100 fixed relative to the press mainframe, projects into a receiving detent cavity 101 to positively lock the carriage at the illustrated engagement position.

As illustrated in phantom in FIG. 4, the carriage is leftwardly linearly movable back from the illustrated engagement position to a disengagement position 105 which is utilized when the press is operating in a single-color mode. Movement from the illustrated engagement position to the phantom-illustrated disengagement position 105 is accomplished by rotation of the cam member about its pivot pin 98 for approximately 180 degrees from its position illustrated in FIG. 4, causing the pin 99 to move downwardly and drop out of the detent cavity 101, wherein the operator pulls the carriage back away from the printer head 16 to the disengagement position 105, and wherein the cam member 96 is again rotated 180 degrees about the pivot pin 98 to push the pin 99 upward into a disengagement detent cavity 102 for positive locking of the carriage 18.

The carriage is also linearly movable to a further degree away from the printer head 16 to a wash-up position 106 at which the carriage is positively lockable by a mechanism similar to the detent mechanism 95 but not illustrated. It is further noted that the nonoperator side (FIG. 6) of the carriage 18 may include a detent locking mechanism which is opposite but substantially identical to the illustrated detent mechanism 97. The opposed detent mechanism and the illustrated operator side detent mechanism 97 can operate together via a common shaft extending across the carriage from the location of (and in substitution for) the pivot pin 98 to the pivot pin location of the opposed detent mechanism. Such a mechanism permits positive locking of both sides of the carriage 18.

The carriage is further movable to a lock-back position 107 farthest from the printer head 16, wherein positive locking of the carriage in the lock-back position 107 is provided by the pivotally movable latch member 110 mounted to the carriage via a pivot pin 112. As the carriage moves away from the printer head to the lock-back position, the latch member is raised up by a horizontally inclined camming surface 114 for latching engagement with a keeper 115 in the form of a horizontally projecting pin or rod fixed relative to the mainframe in a manner to be explained in more detail.

The rotatable mounting and fixing of the second plate cylinder 55 to the printer head ensures proper alignment between such second plate cylinder 55 and the blanket cylinder 60. The provision of a linearly movable carriage containing the set of dampening and inking rollers 90 which can be withdrawn from the second plate cylinder 55 advantageously permits ready access to the second plate cylinder and to the carriage-mounted dampening and inking rollers for set up procedures and usual maintenance.

Turning to FIGS. 5 and 6, a more detailed illustration of the carriage 18 is presented from the operator's side as shown by FIG. 5 and from the opposed or nonoperator's side shown in FIG. 6. The carriage rides upon a pair of straight parallel rails 120 (FIG. 5) and 122 (FIG. 6) which are supported by and mounted relative to the mainframe of the press. The carriage is movable along the rails 120, 122 between a pair of lock-back, end stop, ringlike collars 125, 126 and the printer head 16 with which the carriage abuts in its engagement position. The collars 125, 126 fit around the rails 120,122 not immediately adjacent to the printer head 16 and are locked to their respective rails 120, 122 by, for example, appropriate setscrews.

The rails are each supported along substantially their entire lengths by an associated pair of L-shaped cross section lengths of angle iron 135, 137 and by generally equal parallel extending lengths of generally-rectangular cross section bar stock 136, 138 positioned between and engaging the angle iron lengths 135, 137 and the respective rails 120, 122. The rails 120, 122, the lengths of bar stock 136, 138, and the lengths of angle iron 135, 137 are rigidly fixed to each other by appropriate fastening means, such as bolts, welds or the like. The lengths of angle iron 135, 137 are in turn rigidly fastened to the press fame. Thus, straight rails 120, 122 rigidly fixed relative to the press frame are parallel to each and extend along and are parallel to an axis normal to the axis of rotation of the second plate cylinder 55 (FIG. 4). The set of dampening and inking rollers 90 have axes of rotation which are normal to the linear motion direction of the carriage and parallel to the axis of rotation of their associated plate cylinder 55.

As illustrated in FIGS. 5 and 6, the carriage 18 having a generally rectangular base area rides the rails 120, 122 on supportive rolling friction bearing means in the form of two pairs of linear motion partial ball bushings 140, 145, each pair riding a respective rail 120, 122. Such

mounting of the carriage structure advantageously provides positive linear motion of the carriage 18 toward the printer head 16 without lateral or skewing movements of the carriage 18 relative to the printer head 16, which could cause misalignment between the set of inking and dampening rollers 90 and the respective second plate cylinder 55.

Turning to FIG. 7, it can be seen that the length of angle iron 135 has a vertically extending leg 131 which is fastened to the press frame by appropriate bolts 132 (only one illustrated). A horizontally extending leg portion 133 of the length of angle iron 135 supports the generally equal length of bar stock 136 which has a generally rectangular cross section (shown more clearly in FIG. 8). The length of bar stock 138, as illustrated in FIG. 7, is held in place against the horizontally extending flange 133 by appropriate bolts 139 (only one shown). The lock-back collar 125 fastened to an end of the rail 120 farthest from the printer head 16 has extending from it in a generally horizontal direction outwardly from the carriage the keeper 115 with which the latch member 110 engages when the carriage is in its lock-back position (FIGS. 4 and 5) as illustrated and earlier discussed with regard to FIG. 4.

Turning to FIG. 8, the mounting of the carriage 18 upon the rails 120, 122 is further illustrated. It can be seen that the ball bushings 140, 145 extend only partially about the circumferential extent of the rods 120, 122. Such linear motion partial ball bushings are further illustrated in FIGS. 9 and 10, where it can be seen that a series of circulating ball bearings move in a line along the longitudinal extent of the rail 20. In FIG. 10 it can be seen that the weight of the carriage is substantially supported only by the lines of recirculating ball bearings so as to provide only rolling friction forces between the carriage and the rail upon which it is movable. Linear motion partial ball bushings of the type illustrated are known in the art and available from Thomson Industries, Inc. of Manhasset, N.Y. With regard to the rail 122 and its related ball bushings 145, it should be noted that their structural relationship to each other is generally identical to the structural relationship between the other rail 120 and ball bushings 140 as discussed with regard to FIGS. 7, 9 and 10.

Turning to FIG. 11, there is illustrated in more detail from the operator's side the printer head 16 which is mounted on and fixed to the mainframe 10 of the press using a plurality of supportive bolts 151. The printer head 16 has rotatably mounted on it the plurality of parallel oriented and generally abutting cylinders in the form of the first plate cylinder 50, the second plate cylinder 55, the blanket cylinder 60, the impression cylinder 65, and the delivery cylinder 70. The rotatable mounting of the second plate cylinder 55 utilizes an eccentric mounting 155 well-known in the art which permits limited translational shifting of the second plate cylinder 155 to and away from the blanket cylinder 60 where, for example, only a single-color operation is required when only the plate cylinder 50 is engaged with the blanket cylinder 60. Such translational shifting of the plate cylinder 55 causes opening and closing of the switch means 37 (FIG. 1) illustrated in FIG. 11 as a microswitch response to press linkage movements associated with the noted translational movement of the plate cyiilinder 55. The utilization of the switch means 37 will be discussed in more detail with regard to the press safety interlock system. The control linkage illustrated in FIG. 11 is of the typical type.

With reference to FIG. 12, there is illustrated in longitudinal across section an operator-accessible mechanism for axially adjusting the second plate cylinder 55 to establish proper superposition or registry of the two-plate cylinder images transferred to the blanket cylinder as explained earlier.

The second plate cylinder 55 is rotatably mounted on and between two opposed and parallel printer head frame members 160, 161. Opposed, cylindrical, aperture-defining walls 162, 163 concentric with a common axis 165, each engagingly receive respective concentric, cylindrical, ringlike bushings 168, 169, which each include respective radially extending flange portions 168a, 169a. The bushings 168, 169 are fixed within the apertures defined by the walls 162,163 to their respective frame members 160, 161 by appropriate screw fasteners 170.

Extending between the bushings 168,169 is a plate cylinder shaft 175 which has a cylindrical midportion 177 having an axis of revolution 178 which is eccentrically set off by a predetermined amount from the axis 165 along which the concentric bushings 168,169 are oriented. The shaft 175 further includes a non-threaded cylindrical end portion 180 received by the bushing 168. The shaft 175 further includes a threaded cylindrical end portion 185 received by the bushing 169. The cylindrical end portions 180,185 lie along their common axes of revolution 165, while the shaft midportion 177 lies along its axis of revolution 178. The two axes 165,178 are parallel to each other wherein the end portions 168,169 of the shaft are eccentric by an equal radial and angular degree relative to the shaft midportion 177. Both of the axes 165,178 are normal to the parallel plane defined by the frame members 160,161 to provide parallel positioning of the second plate cylinder 55 relative to the blanket cylinder 60 (FIG. 11), which is also mounted along an axis normal to the planes defined by the frame members 160,161.

The plate cylinder 55 is rotatably mounted upon reduced end portions 179 (only one shown) of the midportion 177 of the shaft 175. Suitable bearing means, such as tapered roller bearings 181 (only one shown), are utilized at each end of the cylindrical plate cylinder 55 to rotatably mount it on the shaft 175 which is generally not rotatable around the axis 178. The shaft 175 is axially movable to a limited degree between the frame members 160,161 by being axially slidably and rotationally received within the bushings 168,169.

Limited translational movement of the plate cylinder 55 to and from and into and out of engagement with the associated blanket cylinder 60 (see FIG. 11) is provided by rotation of the eccentric end portions 180,185 on the axis 165, such end portion rotation causing the noted translational movement of the shaft midportion 177 and the associated rotationally mounted plate cylinder 55. A suitable linkage 176 (as further illustrated in FIG. 11) is utilized to rotate to a limited degree the shaft end portions 180,185 to provide the noted translational movement of the rotatably mounted cylinder 55. The linkage 176 is fixed to the distal end of the nonthreaded end portion 180 by means of a bolt 190 and shaft key means 191 to limit the degree of rotation of the shaft 175 to substantially less than a full revolution. The use of such eccentric cylinder mountings (Also see element 155, FIG. 11) is well-known in the art, and such mountings can be adapted to any of the cylinders or rollers of the press where such a translational movement function is desirable.

To adjust and maintain the position of the axially movable shaft **175** slidable within the ringlike bushings **168,169**, an adjustment mechanism **190** is provided in accordance with the invention. The mechanism **190** includes a spindle **195** having a shaft-engaging end **200** and an operator-accessible distal end **202** which extends through the printer head cover **38** for operator access. The spindle **195** is rotatable on the axis **165**, and in a preferred form includes a tube having outer and inner cylindrical walls **194,196**. The shaft-engaging end **200** of the spindle **195**, which further includes a ringlike collar **197**, is threaded on its inner cylindrical wall **198** to engagingly receive the threaded end portion **185** of the shaft **175**. While the spindle **195** is rotatable about the axis **165**, it is generally not translationally movable along the axis **165**. On the other hand, the spindle **175**, while axially movable to a limited degree, is in general not rotatable about the axis **178**, but for the limited degree of eccentric shaft rotation to cause the earlier-discussed translational movement of the cylinder **55**. It can be seen that rotation of the spindle **195**, which is generally fixed axially, will cause axial movement of the generally nonrotatable shaft **175**. The degree of movement caused by a single revolution or rotation of the spindle **195** depends upon the thread pitch of the threaded end portion **185**.

To maintain a set axial position of the shaft **175** and its rotatably mounted plate cylinder **55**, a friction biasing means is provided to lock the spindle at a particular rotational location and to substantially limit axial movement of the rotatable spindle **195**. In a preferred form, the friction biasing or locking means includes a spindle flange portion **205** extending radially from the shaft-engaging end portion **200** of the spindle **195**. The flange portion **205** provides first and second annular friction engaging faces **207, 209** which are concentric with the spindle **195**. The first annular face **207** engages with a corresponding annular area of the frame provided, as illustrated, by the bushing flange portion **169***a*. The second annular face **208** frictionally engages with a corresponding opposed annular area provided by a ringlike member **212** which is biased against the second annular face **208** of the flange **205** by appropriate helical spring means **214** extending between the distal ends of studs **216** extending normally from the frame member **161**, the studs **216** having lengths substantially in excess of the thick of the flange **205**, as illustrated. The studs **216** are equidistantly spaced about the spindle **195** and project through correspondingly equidistant space apertures **211** through the ring member **212**. Spring biasing of the ring member **212** against the flange **205** effectively sandwiches the flange between the biased ring member **212** and the bushings **169** to limit axial movement of the rotatable spindle **195**. The clutching effect provided between the annular faces **207, 208** and the respective mating annular portions of the bushing **169** and ring member **212** act as an effective means to maintain the axial position of the plate cylinder **55** once it has been set by operator turning of the spindle end **202**, which may include a knob **218** fixed thereto. A conventional grease fitting **219** is fixed to the distal end of a hollow rod **220** having its other end **221** threaded into an axial bore (not shown) through the spindle **185**, the axial bore communicating with the pair of roller bearings **181**. Lubricant is applied under pressure via the grease fitting **219**, the hollow rod **220**, and the spindle axial bore (not shown) to the roller bearings **181**. Also fixed about the rod **220** at its distal end is a ring-like stop member **222** which moves between the distal end of the spindle **195** and the knob **218**, as illustrated, to limit the range of axial movement of the plate cylinder **55**.

With reference to FIG. **13** and FIG. **1**, the earlier-discussed interlock control system for ensuring safe operation of the press of the present invention will now be discussed in further detail. FIG. **13** is a generally schematic diagram of the interlock control system in accordance which the invention with incorporates the earlier noted switching means **19, 21, 23, 30, 32, 37**, as geometrically located and as functionally described with regard to FIG. **1**. The interlock system includes a conventional pair of power lines **300, 302**. Extending across the power lines **300,302** in parallel relation for electrical energization are a press motor **305** and a paper handling vacuum pump **307**. Electrically connected between the power lines **300,302**, and in series with the press motor **305**, is a fuse **306** of the conventional type and a set of normally open relay contacts **304**. It can be seen that power will be applied to the press motor **305** when the normally open contacts **304** are closed. In likewise fashion, a set of normally open relay contacts **308** are provided in series with the vacuum pump **307** wherein closing of the contacts **308** applies power to the pump **307**, the vacuum pump providing paper to the printer head **16** (FIG. **1**) from the paper feed input **12**. The operation of the vacuum pump **307** and its utilization in the paper feed input **12** are well-known in the art. Also connected across the power lines **300, 302** are a motor control circuit **320** and a vacuum pump control circuit **340**.

The motor control circuit **320** includes, in serial relation and in electrical series relationship between the power lines **300, 302**, the paper delivery interlock switch means **19**, a carriage/printer head interlock switch means **322** which includes switching means **35, 36, 37**, the other paper delivery interlock switch means **21**, the printer head movable cover interlock switch means **30, 32**, an on-off rocker switch **325**, and a motor relay **330**.

In operation, the rocker switch **325**, having two sets of serially connected contacts **326, 327** and illustrated in its at-rest position, is momentarily switched by the operator to an on condition wherein the set of contacts **327** close. If all of the press interlock switch means (**19,322,21,30,32**), disregarding switch means **23**, are in their proper condition, as will be subsequently explained, power is applied to the press motor relay **330**. Upon power actuation to the press motor relay **330**, the set of press motor contacts **304** are closed to apply power to the press motor **305**. Also closed by the actuation of the relay **330** are a set of latching contacts **328** which parallel and bridge the contacts **327**, which, after being momentarily closed by the operator, are returned to the position illustrated such that the contacts **327** are opened and the latching contacts **328** are closed or latched. The relay continues to be powered and to maintain the motor contacts **304** in a closed condition for press motor energization. To turn off the press motor, the operator need only push the rocker switch **325** to its off position wherein the contacts **326** are momentarily open to deenergize the relay **330** and to open the latching contacts **328** and the motor contacts **304**. Return of the contacts **326** to their illustrated at-rest, closed position will not affect the deenergized condition of the press, since both sets of contacts **327** and **328** are now open.

The functioning of the various safety interlock switches within the press motor control 320 will now be discussed.

With the press in an on condition, with the relay 330 being energized via the closed latching contacts 328, the press will continue to run unless an unsafe condition is presented in the form of, for example, an open condition of any of the covers 15, 17, 24 or 26, as earlier explained with respect to FIG. 1. The opening of the noted covers during an operating condition of the press would actuate their respective interlock switches 19, 21, 30 or 32 to an open circuit condition. Opening of any of these series of connected interlock switches 19,21,30,32 will deenergize the relay 330 and shut down the press motor 305 due to the opening of contacts 304, as explained earlier. With regard to the series-connected carriage/printer head interlock control 322, the printer head interlock switch means 37 switches between its two illustrated positions as a function of translational movement of the second plate cylinder to (engagement) and away from (disengagement) of the blanket cylinder. The carriage interlock switches 35 and 36, on the other hand, are actuated in accordance with the degree of carriage movement away from the printer head. The switch means 35, 36, 37 cooperate together to limit operator access to the moving plate cylinder when it is turning as a result of engagement with the blanket cylinder and actuation of the press motor 305. With the carriage at its engaged position and with the second plate cylinder engaged with the blanket cylinder, switch 37 is positioned as illustrated in FIG. 13, switching means 36 is closed, and switching means 35 is open. Under these switch conditions, the press motor operates in a normal manner. With the carriage moved to its disengaged position 105 (FIG. 4) the switch means 36 opens and the press motor will not operate until the second plate cylinder is shifted translationally away from and out of engagement with the blanket cylinder. Such shifting of the second plate cylinder throws the switch 37 from the position shown in FIG. 13 to its other position wherein it is in series with switch means 35, which is now closed as a result of carriage movement away from the printer head to the disengagement position. At the wash-up position 106 (FIG. 4) of the carriage, switch means 26 is open and switch means 35 is closed. Press motor actuation for driving of the carriage dampening and inking rollers 80 (FIG. 4) for wash-up purposes can only occur when interlock switch means 37 is in its other position, i.e., when it is actuated by translational movement of the second plate cylinder away from the blanket cylinder so that the cylinder will not rotate, thus exposing the operator to an unsafe position. Finally, when the carriage is moved all the way back to its lock-back position 107, both carriage interlock switch means 35, 36 are in an open circuit condition and the press motor will not operate regardless of the position of the plate cylinder actuated interlock switch means 37. Thus, it can be seen that the press motor interlock switch means 320 provides quick deenergization of the press whenever an unsafe operating condition, as earlier discussed, exists.

Turning to the vacuum pump control circuit 340, a second relay 345 is connected between the power lines 300 and 302 via a series-connected second rocker switch means 346 and the bin overload interlock switch means 23. The rocker switch means 346 functions in the manner similar to that as earlier explained with regard to rocker switch 325, wherein moving of the rocker switch 346 to an on position energizes the vacuum pump relay 345 and its latching contacts 347, and vacuum pump contacts 308, which in turn energize the vacuum pump 307. When an overload condition within the bin 30 (FIG. 1) is sensed by the interlock switch means 23, opening of interlock switch 23 deenergizes the vacuum pump relay 345, which in turn opens contacts 308 and 347. Reenergization of the vacuum pump motor 307 requires that the operator once again momentarily move the rocker switch 346 to its on condition after the printed paper has been removed from the bin 30 (FIG. 1) to reset the interlock switch means to a closed position.

Although a preferred embodiment of this invention is illustrated, it should be understood that various modifications and rearrangements of parts may be resorted to without departing from the scope of the invention disclosed and claimed herein.

What is claimed is:

1. An offset printing press comprising:

a mainframe including paper handling means, the paper handling means defining a paper handling path extending between a paper feed input and a paper delivery output;

a printer head mounted on and fixed to the mainframe and engageable with the paper handling path at a location generally intermediate the paper feed input and the paper delivery output, the printer head including a single blanket cylinder and a pair of plate cylinders, the plate cylinders being simultaneously engageable with the blanket cylinder, the plate cylinders and blanket cylinder being adjacent to each other and rotatably mounted on the printer head along generally parallel axes, the blanket cylinder being adapted to simultaneously transfer images from the plate cylinders to paper provided by the paper handling means;

a movable carriage mounted on the mainframe and located generally adjacent to the printer head, the carriage being substantially linearly movable along a generally straight line to and from the printer head, the carriage having a rectangular base including four linear motion ball bushings and located at a respective one of the four corners of the rectangular base, the mainframe including a pair of parallel rails upon which the ball bushings ride, the ball bushings engaging the rails to substantially eliminate carriage movement in directions generally perpendicular to the straight line along which the carriage moves, the carriage being positively lockable at predetermined positions along the generally straight line of linear movement;

a first set of dampening and inking rollers rotatably mounted on and fixed to the printer head and engageable with one of the plate cylinders; and

a second set of dampening and inking rollers rotatably mounted on and fixed to the carriage and engageable with the other of the plate cylinders when the carriage is moved toward the printer head to an engagement position.

2. An offset printing press according to claim 1, wherein the rails are circular cross sectional rods supported along substantially their entire lengths by the mainframe.

* * * * *

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United States Patent [19]

Rebel

[11] 4,372,244

[45] Feb. 8, 1983

[54] VARNISHING UNITS ON PRINTING PRESSES

[75] Inventor: Herbert Rebel, Rödgau, Fed. Rep. of Germany

[73] Assignee: M.A.N.-ROLAND Druckmaschinen Aktiengesellschaft, Fed. Rep. of Germany

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[52] U.S. Cl. 118/46; 118/222; 118/262

[58] Field of Search 118/204, 221, 222, 262, 118/46

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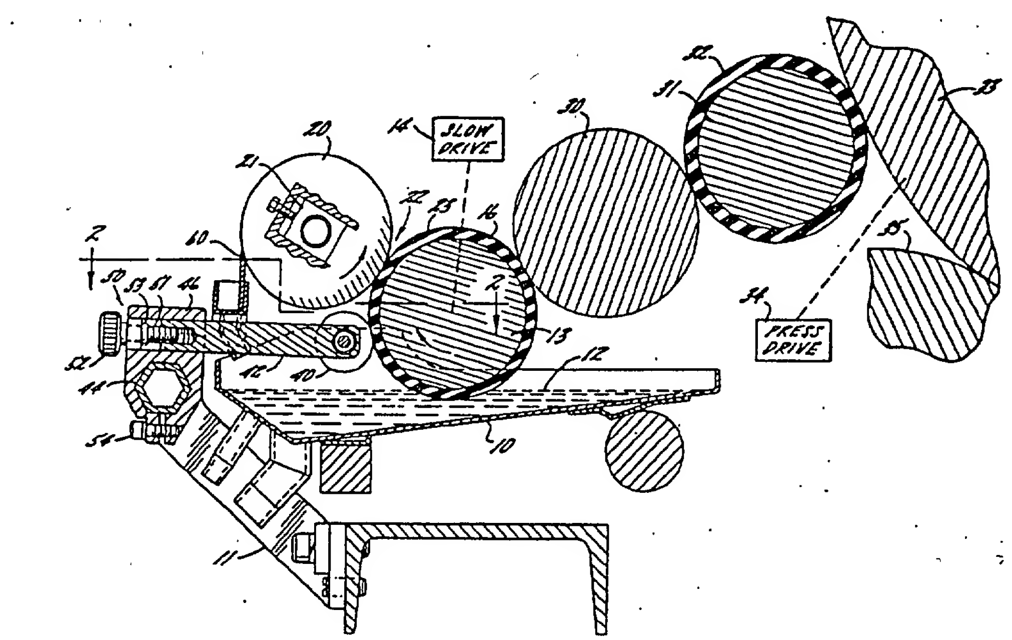
Primary Examiner—Evan K. Lawrence

Attorney, Agent, or Firm—Leydig, Voit, Osann, Mayer & Holt, Ltd.

[57] ABSTRACT

A varnishing unit for applying varnish in a strip of selected width on a sheet carried on the impression cylinder of a printing press distinguished by use of a plurality of adjustable varnish blocking rollers arranged adjacent a fountain roller between a varnish trough and a metering nip formed between a metering roller and the fountain roller. The blocking rollers are hard surfaced and of relatively small diameter, and are secured to the frame by arms located at the respective ends of each roller. Each blocking roller is individually adjustable between (a) a position in which it forcibly indents the surface of the fountain roller so as to substantially cut off the flow of varnish to the metering nip, in the region of width controlled by the blocking roller and (b) a position withdrawn from the surface of the fountain roller to permit passage of a strip of varnish in the controlled region to the metering nip and thence via intermediate rollers to the varnishing cylinder. The arms can be differentially adjusted so that the flow of varnish may be blocked off at one end of the roller but not at the other to achieve a varnish strip of a width which is less than the length of the blocking roller. Furthermore, the arms on which the blocking rollers are mounted are slidable on a cross beam which extends parallel to the fountain roller to permit adjustment of the position of the region controlled by the blocking roller.

4 Claims, 5 Drawing Figures



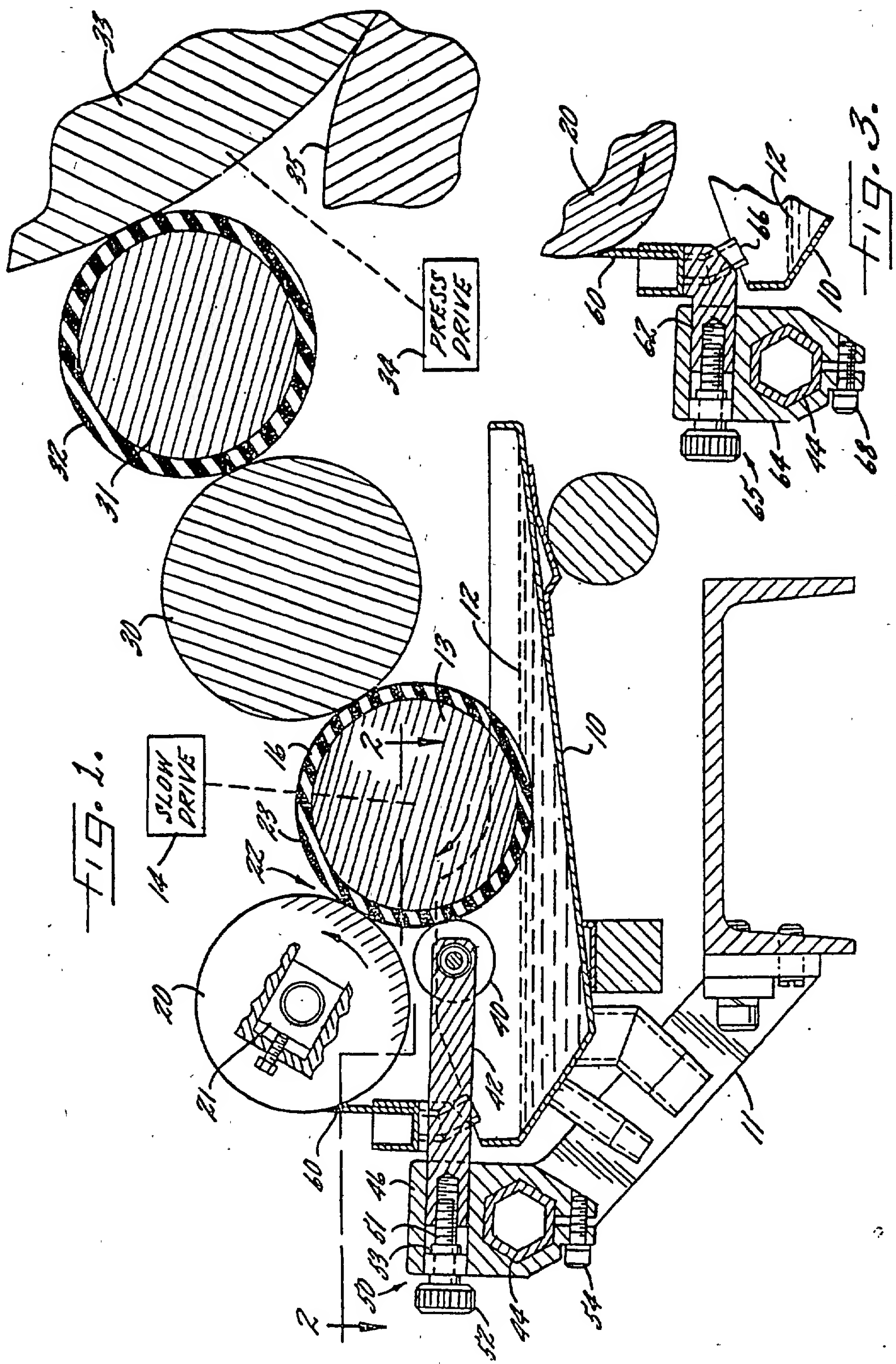


Fig. 1.

Fig. 3.

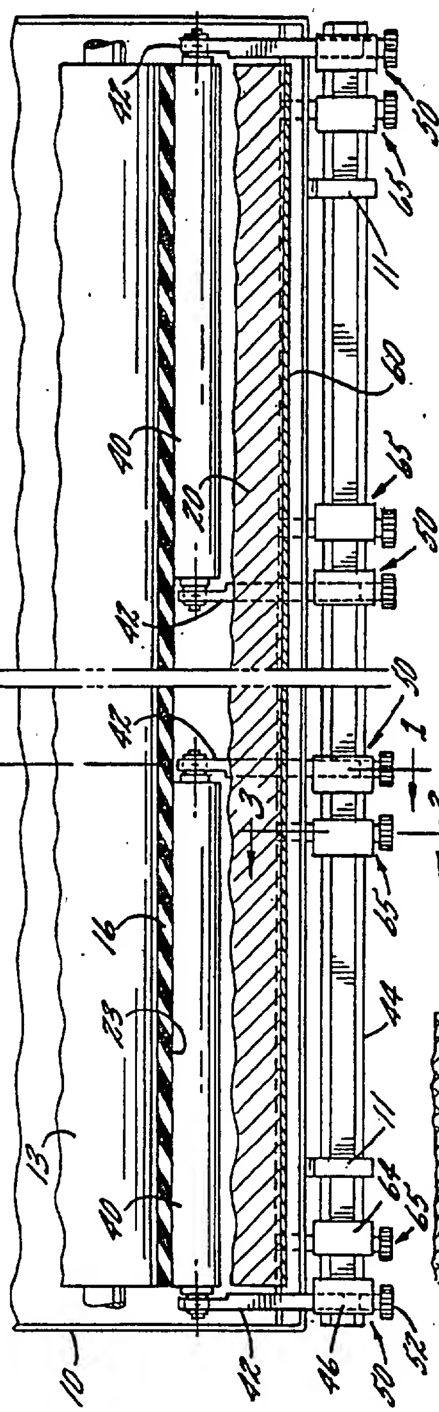


FIG. 2.

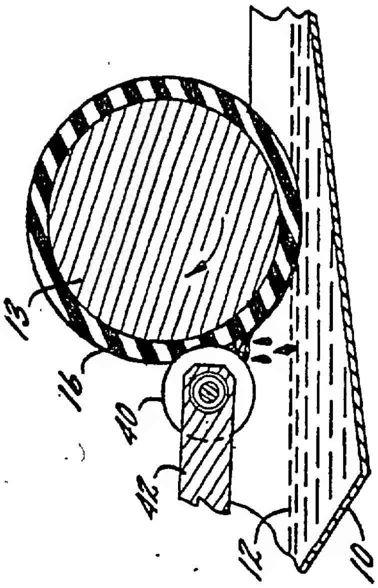


FIG. 5.

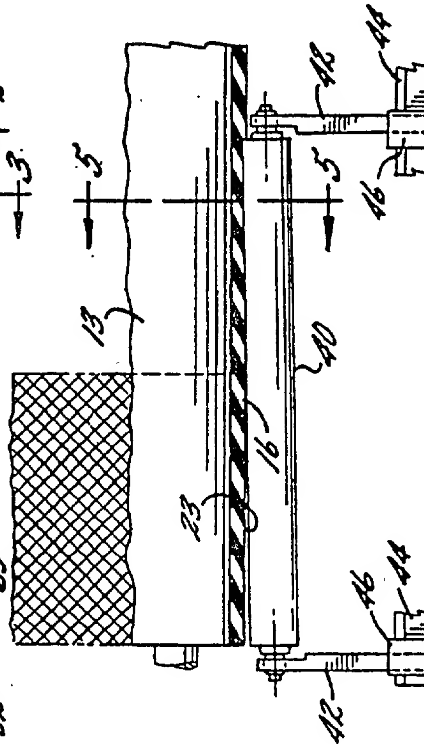


FIG. 4.

VARNISHING UNITS ON PRINTING PRESSES

When printing pages requiring a glossy finish, as is common in many of today's magazines and catalogues, a varnish must be applied to the printed sheet to provide the gloss. As is well known in the art, varnish is transferred through a series of rollers to a varnishing cylinder, which rollingly engages an impression cylinder to transfer the varnish to the printed matter carried by the impression cylinder. However, a problem has arisen when sheets of various size are sought to be varnished. There has not been a satisfactory way to use a single varnishing unit to apply varnish to sheets of different width, or to apply varnish in a strip of a desired width and location on a sheet.

It is, accordingly, an object of the present invention to provide a varnishing unit for a printing press which can be used to apply varnish to printed sheets of various width or in a strip of desired width and location. It is a related object to provide a varnishing unit in which the working areas of the rollers which transfer the varnish to the varnishing cylinder can be quickly and easily adjusted. A further object lies in the provision of an adjustable width varnishing unit which is both economical and simple to make and operate.

More specifically, it is an object of the present invention to provide blocking rollers which are adjustable both endwise and in skewed engagement with a fountain roller to selectively control the working areas of the fountain roller, its metering roller, and other rollers which carry the varnish eventually transferred to the varnishing cylinder for application to the printed matter.

Other objects and advantages of the invention will become apparent upon reading the attached detailed description and upon reference to the drawings in which:

FIG. 1 is a vertical cross-sectional view taken generally along line 1—1 in FIG. 2 showing a varnishing unit embodying the present invention;

FIG. 2 is a plan view in partial section taken generally along line 1—1 in FIG. 1;

FIG. 3 is a fragmentary section taken along line 3—3 of FIG. 2 showing a scraper blade forming part of the present invention;

FIG. 4 is a partial plan view, similar to the view in FIG. 2, showing a blocking roller adjusted to permit varnish to be transmitted only over a narrow width on the fountain roller; and

FIG. 5 is a fragmentary section taken along line 5—5 in FIG. 4 showing the blocking effect of the blocking roller.

While the invention will be described in connection with a preferred embodiment, it will be understood that there is no intention to limit the invention to the construction shown but, on the contrary, but it is intended to cover the various alternative and equivalent constructions included within the spirit and scope of the appended claims.

Turning now to FIG. 1, there is shown a typical varnishing unit having a trough 10, supported by a frame 11, for holding the varnish supply 12, and a fountain roller 13 which is partially immersed in the varnish supply so that, upon rotation of the fountain roller 13 by a slowly rotating driving means 14, the entire submerged length of the fountain roller 13 will be coated with varnish. The fountain roller 13 is provided with a resilient surface layer 16 and is rollingly engaged by a hard-surfaced metering roller 20 to form a metering nip 22. The metering roller 20 includes means 21 for adjusting the degree of indentation of the metering roller upon the fountain roller. The degree of this indentation determines the thickness of the film of varnish 23 which will cling to the fountain roller 13 on the downstream side of the metering nip 22.

Downstream of the metering nip 22, the fountain roller 13 is engaged by a hard-surfaced distributor roller 30. The distributor roller 30 accepts the film of varnish from the fountain roller 13 and in turn transfers the film to a form roller 31 having a resilient surface layer 32, which is mounted for rolling engagement with the distributor roller 30. The form roller 31 in turn transfers the film of varnish to a varnishing cylinder 33, which is driven by a press drive 34. The varnishing cylinder 33 is arranged for engagement with a sheet of printed matter (not shown) carried on a conventional impression cylinder 35, shown symbolically, so that the film of varnish carried by the varnishing cylinder 33 is applied to the sheet. Slippage occurs between rollers 13 and 30.

In carrying out the present invention, a plurality of varnish blocking rollers 40 are arranged adjacent the fountain roller 13 between the varnish trough 10 and the metering nip 22 when viewed in the direction of rotation of the fountain roller. The blocking rollers 40 are hard surfaced and of relatively small diameter in comparison with the fountain roller 13. The blocking rollers 40 are mounted to the frame 11 and have adjusting means for individual adjustment of each blocking roller between (a) a position in which the blocking roller forcibly indents the resilient surface of the fountain roller to substantially cut off the flow of varnish to the metering nip 22 in the indented region of the fountain roller, and (b) a position in which the blocking roller 40 is withdrawn from engagement with the fountain roller 13 to permit a passage of a film of varnish on the section of the fountain roller which is potentially engageable with the blocking roller 40. This film of varnish travels through the metering nip 22 and is eventually transferred to the varnishing cylinder 33 for application to the sheet on the impression cylinder 35. Thus, each blocking roller 40 defines a controlled region of width on the fountain roller for the transmission of varnish.

More specifically, each blocking roller 40 is journaled at its respective ends by a pair of arms 42. These arms 42 are secured to a cross beam 44 through brackets 46, the cross beam 44 being secured to the frame 11 and extending parallel to the fountain roller 13. Each bracket 46 mounts an arm adjusting mechanism 50 which includes a threaded screw 51 having a knob 52 and a collar 53. The threaded screw 51 engages the internal threads of a bore in each arm 42, while the collar holds the screw captive in the bracket. By rotating the knob 52, and thus either screwing the thread 51 into or out of the threaded bore in the arm 42, the blocking roller can be either moved into engagement with, or away from, the fountain roller 13. As shown in FIG. 5, the arms may be adjusted so that the blocking roller 40 forcibly indents the surface of the fountain roller 13 so that the flow of varnish is substantially completely blocked off, with the intercepted varnish simply dripping back into the trough.

Because no varnish will be carried on the resilient surface 16 of the fountain roller 13 which is indentedly engaged by a blocking roller 40, the region or zone of the fountain roller 13 which does not transmit a film of

varnish can be varied by selective engagement of a blocking roller. Thus, the width of the film of varnish, and the active regions of the rollers over which it is transmitted, can be adjusted so that a film of varnish is applied to only a selected portion of the varnishing cylinder 33.

Also in keeping with the present invention, each bracket 46 is clamped to the cross beam 44 with a screw 54. With these clamping screws 54 loosened, the brackets 46 and their corresponding arms 42 can be shifted along the cross beam 44 to achieve endwise adjustment of each blocking roller, thus permitting endwise adjustment of the position of the region controlled by the blocking roller for control of the flow of varnish to the surface of the varnishing cylinder. The present device thus permits a strip of varnish of selected widtih to be carried at a selected position on the fountain roller for eventual transmission to the impression cylinder of a printing press.

In practicing the invention, a scraper blade 60 engages the metering roller 20 on the downstream side of the nip 22 to scrape off varnish which clings to the metering roller 20, returning it to the trough 10. The scraper blade 60 allows the metering roller 20 to act on the fountain roller 13 without affecting the varnish-free areas of the fountain roller, as any residual varnish has been substantially removed from the metering roller. As best seen in FIG. 3, the resilient scraper blade 60 is held by arms 62, which are in turn held in adjustable brackets 64 mounted on the cross beam 44. The arms 62 are mounted for movement within the bracket 64 in an adjusting device 65 similar to that disclosed at 50 with respect to the arms which hold the blocking rollers. The adjustability of the radial position of the scraper blade permits the blade to be moved in concert with the metering roller 20, as the metering roller is moved to vary the degree of its indentation upon the fountain roller, which varies the quantity of varnish carried by the fountain roller.

The scraper blade 60 transmits the varnish scraped off the metering roller 20 back into the varnish trough 10 through a return channel 66, which is held by the arms 62. Similarly to the brackets 46 disclosed in conjunction with the blocking rollers, brackets 64 are also slidable along the length of the cross beam 44. Each bracket 64 has a clamping screw 68 which, when a desired position of the slidable bracket 64 is reached, can be tightened to securely hold the scraper blade in its desired position. A single scraper blade which extends over the full length of the metering roller is preferred, although multiple scraper blades may be employed if desired, one corresponding to each blocking roller. The removal of the excess varnish on the metering roller by the scraper blade insures that no varnish can be recirculated on the on the metering roller back to the metering nip.

In keeping with the invention, each arm adjusting mechanism 50 can be independently manipulated so that one end of its corresponding blocking roller 40 forcibly indents the surface of the fountain roller 13 to block off, at that end, the flow of varnish to the metering nip 22, while the other end of the blocking roller is withdrawn from the fountain roller 13 by its arm adjusting mechanism 50. This is best shown in FIG. 4 and allows for a strip of varnish of a width less than the length of the blocking roller 40 (indicated by the cross-hatching in FIG. 4) to be transferred by the fountain roller 13 to, eventually, the varnishing cylinder 33 for application to a sheet on the impression cylinder 35. Thus, by selectively adjusting the portion of a blocking roller 40 which engages the fountain roller 13, the varnish strip which is carried by the fountain roller can be varied to any length less than the length of the blocking roller.

It will be apparent that the objects of the invention have been amply fulfilled. The blocking rollers 40 mounted on slidable adjustable arms 42 and brackets 46 permit a strip of varnish of a selected width to be carried by a selected region of the fountain roller for application to a sheet of printed material carried by the impression cylinder.

I claim:

1. A varnishing unit for applying varnish in a strip of selected width on a sheet carried on the impression cylinder of a printing press comprising, in combination, a frame, a varnishing cylinder arranged for engagement with the sheet on the impression cylinder, a varnish trough, a resiliently surfaced fountain roller, driving means for slowly rotating the fountain roller in the varnish in the trough, a hard surfaced metering roller in rolling engagement with the fountain roller to form a metering nip, means for adjusting the degree of indentation of the metering roller upon the fountain roller thereby to determine the thickness of the film of varnish which clings to the fountain roller on the downstream side of the nip, a scraper blade on the metering roller on the downstream side of the nip for scraping off the varnish which clings to the metering roller for return thereof to the trough, a hard surfaced distributor roller in engagement with the fountain roller downstream of the nip for accepting the film of varnish, a resilient form roller in rolling engagement with the distributor roller for transferring the film to the varnishing cylinder, and a plurality of varnish blocking rollers arranged adjacent the fountain roller between the trough and the metering nip, the blocking rollers being hard-surfaced and of relatively small diameter, means including arms at the respective ends of each roller and secured to the frame for supporting the blocking rollers end to end so that each defines a region of width on the fountain roller for control of varnish flow, the arms having adjusting means for individual adjustment of each blocking roller between (a) a forcibly indented position on the surface of the fountain roller sufficient to substantially cut off the flow of varnish to the metering nip in the region of width controlled by the blocking roller and (b) a withdrawn position permitting passage of a strip of varnish in the controlled region to the metering nip and thence to the varnishing cylinder, the adjusting means at each end of a blocking roller being differentially adjustable so that flow of varnish may be blocked off at one end of the blocking roller but not at the other thereby to achieve a varnish strip of a width which is less than the length of the blocking roller.

2. The combination as claimed in claim 1 in which the frame of the press has a cross beam extending parallel to the fountain roller, the supporting arms being slidably mounted on the cross beam to achieve endwise adjustment of each blocking roller thereby to adjust the position of the region controlled by the blocking roller for control of flow of varnish to the surface of the varnishing cylinder.

3. The combination as claimed in claim 1 in which the scraper blade extends over the full length of the metering roller.

4. The combination as claimed in claim 2 in which adjustable brackets are provided for mounting the scraper blade, the adjustable brackets being mounted upon the cross beam and having provision for adjustment with respect thereto.

* * * * *

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United States Patent [19]

Makosch

[11] **4,397,237**

[45] **Aug. 9, 1983**

[54] **ROLLER TRAIN STRUCTURE FOR USE WITH PRINTING MACHINE**

[75] Inventor: **Manfred Makosch**, Königsbrunn, Fed. Rep. of Germany

[73] Assignee: **M.A.N.-Roland Druckmaschinen Aktiengesellschaft**, Augsburg, Fed. Rep. of Germany

[21] Appl. No.: **353,608**

[22] Filed: **Mar. 1, 1982**

[30] **Foreign Application Priority Data**

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[51] **Int. Cl.³** **B41F 31/32**

[52] **U.S. Cl.** **101/352**; 101/247; 118/262

[58] **Field of Search** 101/352, 349, 351, 350, 101/209, 247, 148, 139, 140, 143, 144, 145, 182, 184, 185; 118/262

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Primary Examiner—Edgar S. Burr
Assistant Examiner—Moshe I. Cohen
Attorney, Agent, or Firm—Frishauf, Holtz, Goodman & Woodward

[57] **ABSTRACT**

To provide access to an ink application roller (**11**) located circumferentially about the plate cylinder (**1**) and behind another ink application roller (**10**), the inner one (**11**) of the ink application rollers is secured to an inner support plate (**14**) which is pivotable together with an outer support plate (**13**) about a bushing of a bearing (**21**) retaining a milling roller of the ink train, the outer plate additionally supporting other ink distribution rollers (**7, 8**) receiving ink from an ink supply roller (**3**), so that the entire roller train (**B**) formed by the ink distribution rollers (**7, 8**) and the inner one (**11**) of the ink application rollers can be tipped out of engagement position to thereby provide access to those rollers which are located behind the milling roller (**9**). The system is particularly applicable for a double-parallel ink train arrangement in which the respective ink distribution rollers and application rollers are physically located behind another ink train (A) formed by another roller system (**4, 5, 6**).

5 Claims, 2 Drawing Figures

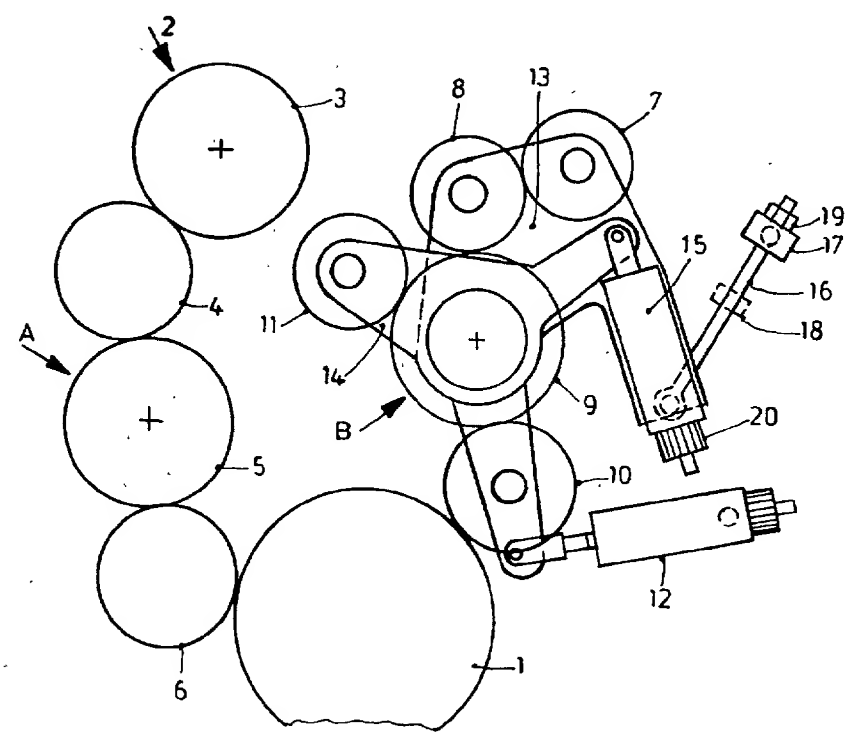

Fig.1

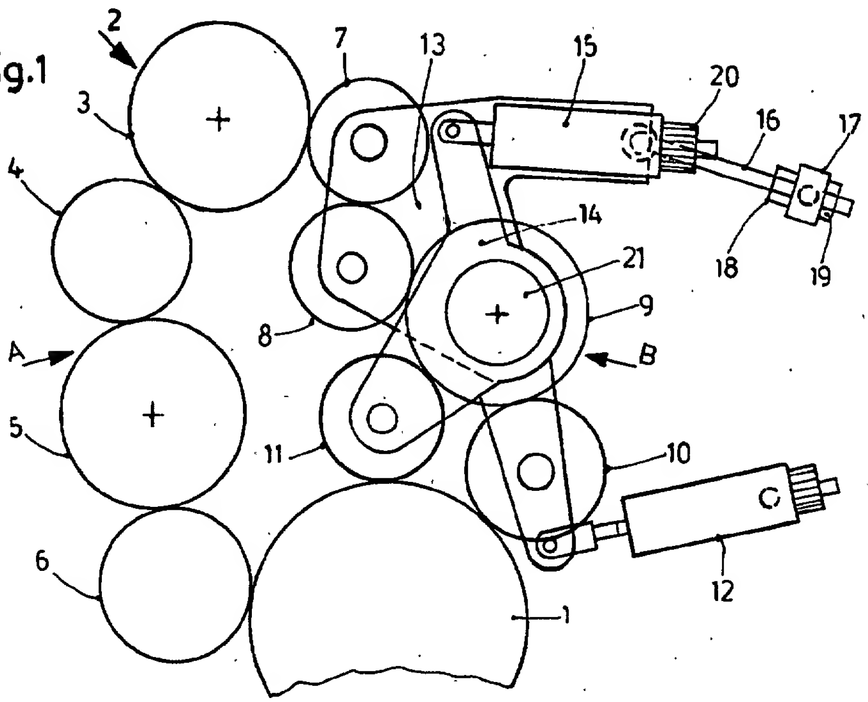
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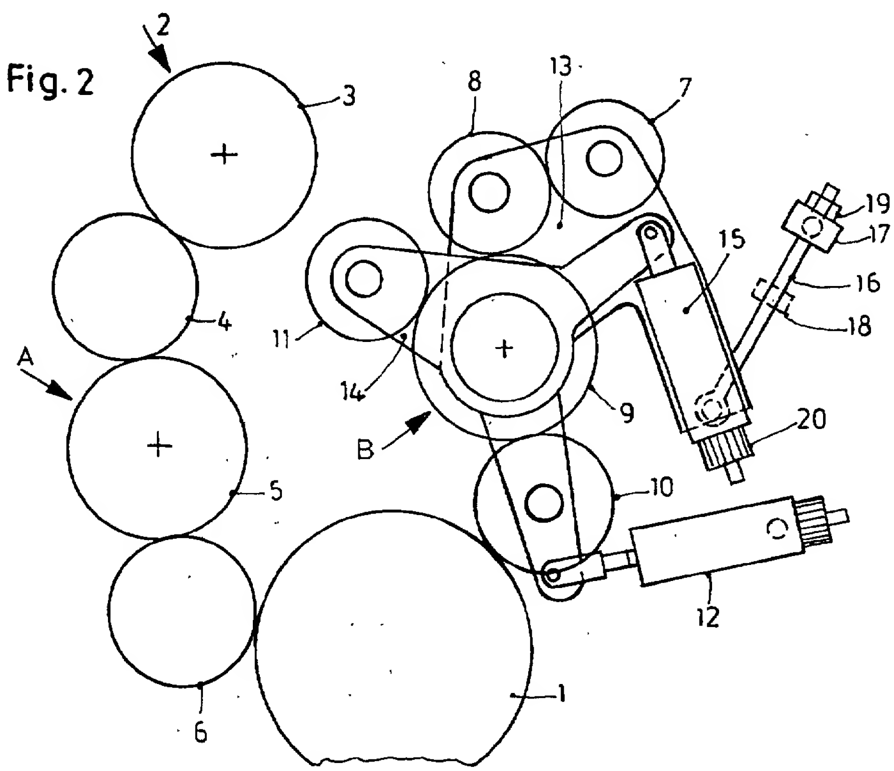
Fig. 2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ROLLER TRAIN STRUCTURE FOR USE WITH PRINTING MACHINE

The present invention relates to a roller train structure which can be applied against a plate cylinder of an offset printing machine or a raised-letter press printing machine, and more particularly to a holder structure suitable for an ink roller train.

BACKGROUND

Roller trains, particularly to distribute ink in the inking system of a printing machine, frequently use a plurality of rollers which are so arranged that some rollers hide other rollers therebeneath, so that access to the inner ones of the rollers is impaired. In some structures, it is desirable to permit movement of rollers towards or away from another engaged roller. British Pat. No. 1,422,421 describes an inking system in which a plate cylinder is inked by a plurality of ink application rollers. The ink application rollers, in turn, receive ink over two roller trains. To permit change-over, or to engage and disengage the inking system, one further roller can be pivoted or tipped about a roller which is journaled in fixed bearings, maintained in a predetermined position in the frame. Such roller trains have disadvantages in that it is difficult to replace certain rollers without disassembling the entire roller train, and particularly without disassembling the rollers which hide the inner ones, or the ones covered thereby. Thus, maintenance and/or exchange of some of the rollers beneath outer ones is difficult, time-consuming, and expensive.

THE INVENTION

It is an object to provide a roller train which permits disassembly or adjustment of any one of the rollers thereof, even though the particular roller may be hidden beneath or behind another one, and without disassembling the outer or covering roller, or roller set or group.

Briefly, a first bearing plate is provided, secured to an outer roller which is maintained in position. The first bearing plate can be pivoted or tilted or rocked about the axis of rotation of this outer roller. At least one roller is retained in the first bearing plate, and in surface engagement with the outermost roller. The bearing plate, further, retains a second bearing plate thereon, which is relatively rotatable with respect to the first one, the second bearing plate supporting at least one inner roller. Positioning control elements are provided secured to the first bearing plate and defining the position of the second bearing plate, and the relative position of the roller or rollers secured thereto. The first bearing plate also has positioning elements associated therewith, permitting rocking or pivoting of the first bearing plate about the axis of rotation of the outermost roller to such an extent that, thereby, the inner rollers which are secured to the second bearing plate become accessible.

The roller train has the advantage that those rollers which, in normal operation, are not readily accessible still can be removed or reached without substantial disassembly time, since it is no longer necessary to disassemble the outer rollers in order to reach, for example, an inner one for replacement because of wear, or for maintenance, or for adjustment. Further, the system is particularly simple to service and to adjust since the inner rollers can be relatively adjusted in their position without requiring disassembly of the outer rollers.

The system can be used in inking systems both for offset as well as for raised-letter presses which have dual or multiple path ink trains. The system further has the advantage that the pivoting arrangement can be easily adjusted by pivoting against a stop so that the positioning of the rollers, after service work, for example on the inner rollers, and after re-positioning, will be retained as controlled, without renewed re-adjustment of the position of outer rollers, which have been tipped or pivoted out of their normal position. Placement of the outer rollers with respect to other rollers or cylinders of the system which have bearings fixed in a frame thus is simple.

DRAWINGS

FIG. 1 is a schematic side view of a portion of the roller train of an inking system, illustrating those parts which are close to the plate cylinder of a rotary offset printing machine, with the rollers in engaged position; and

FIG. 2 illustrates the system of FIG. 1 with the rollers in disengaged or removed position.

The inking system 2 supplies ink to a plate cylinder 1 by applying ink from an ink trough (not shown) and, for example, a ductor roller which supplies the ink necessary for inking of the plate cylinder. Ductor or film-forming or milling rollers may be used in accordance with any known and suitable structure. The ink supply system itself is generally known, and thus not shown in FIGS. 1 and 2. The ink derived from the ink trough is applied to an ink roller 3 and then applied over distribution rollers 4 and 5 to an application roller 6 which provides ink for the plate cylinder 1. This ink train is labeled ink train A. As shown, the ink train is in continuous rolling engagement with the plate cylinder 1.

A parallel ink train B is in rolling contact with the ink roller 3. Ink roller 3 may be a milling roller, and ink is applied to further ink rollers 7 and 8, and from there on a milling roller 9. Two secondary application rollers 10, 11 are in engagement with the milling roller 9 which, together with the application roller 6, provides for uniform inking of the plate cylinder 1.

The secondary ink application roller 11 is positioned inwardly of the rollers 7, 8, 9 and 10, and is therefore hidden behind the rollers. Roller 11 may be termed an inner roller, and access thereto is impeded by the other rollers as well as by the milling roller 9. Thus, the secondary roller 11 cannot be serviced or exchanged or adjusted without removing the outer rollers 8, 9, 10 and, preferably, also roller 7, which together impede access to the roller 11. Roller 10, of course, can readily be exchanged and serviced, and its adjustment position easily controlled by an adjustment element 12, for example a pneumatic or hydraulic cylinder-piston arrangement, which permits engagement and disengagement of the cylinder 10 with the surface of the plate cylinder 1.

In accordance with the invention, the milling roller 9 is secured in bearings 21 in the side walls of the machine (not shown), and thus fixed in position. A first, or outer plate 13 is provided, rotatable or pivotable about the bearing bushings of the milling roller 9. The outer, or first bearing plate 13 is used to receive the bearings of the rollers 7 and 8. Additionally, plate 13 supports a second, or inner bearing plate 14. The second or inner bearing plate 14 is rotatable relative to the outer or first

plate 13 about the axis of rotation of the milling roller 9, for example about the outer bearing bushing thereof.

A similar arrangement, the mirror image of that described, is located at the other axial ends of the rollers. The bearing plate 14, located at the end faces of the milling roller 9 receive the bearings for the secondary ink application roller 11. To properly position the secondary ink application roller 11 in the desired location on the plate cylinder, bearing plate 13 has a positioning element 15 associated therewith, for example a hydraulic or pneumatic piston-cylinder positioning element secured on plate 13, which permits lifting the bearing plate 14 and with it the secondary application roller 11 off the plate cylinder 1 or, alternatively, in engagement therewith; positioned movement of the positioning element 15 coupled to the inner bearing plate 14 is independent of rocking or pivoting movement of the outer bearing plate 13 which carries element 15.

The bearing plate 13 can be pivoted together with the bearing plate 14 by a further positioning element formed by components 16, 17, 18, 19 to pivot the outer bearing plate 13 in clockwise direction about the milling roller 9 so that, in a limiting position, the bearing roller 11, and its adjustment position, is readily accessible—see FIG. 2. This permits, for example, removal of servicing of the roller 11 without the necessity of disassembly of any one of the other rollers of the system.

The locating arrangement for the outer, or first plate 13 includes a guide rod 16 which is pivotably linked to the bearing plate 13 with one end thereof. The other end of the guide rod 16 is threaded and is guided in a rotatable holder 17 which is fixed in position, for example on the frame (not shown) of the machine. Adjustment or positioning nuts 18, 19 are threaded on the guide rod 16 at both sides of the holder 17 so that the position of the guide rod 16 can be predetermined.

Operation: To carry out maintenance work, nut 19 is loosened and, upon rotation of holder 17, the first or outer plate 13, and with it the inner plate 14, is rocked from the position shown in FIG. 1 to the position shown in FIG. 2, where the secondary ink application roller 11 is readily accessible. After carrying out the necessary maintenance work on the secondary ink application roller 11, for example exchange, finishing of the surface thereof, or the like, and while the roller train is in the position of FIG. 2, the position of the adjustment nut 19 is re-established. This insures that the roller 7 will, upon change-over to the position of FIG. 1, have the same distance or engagement pressure with respect to roller 3 which it had prior to pivoting the entire system from the position of FIG. 1 to the position of FIG. 2.

Individual fine adjustment of the ink application roller 11 is carried out by an adjustment button 20, associated with the, preferably pneumatic, lifting or disengagement device 15. As can be seen in FIGS. 1 and 2, the position of the secondary ink application roller 11 with respect to the plate cylinder, once determined by the adjustment knob 20, is not changed when the plates are pivoted about the bearing 21 of the milling roller 9. This substantially simplifies adjustment of the secondary ink application roller 11, and hence results in substantial saving of time. Further, adjustment or maintenance work on the roller 8 of the roller train B is simplified since this roller also becomes freely accessible when the roller train is pivoted or tipped into the position shown in FIG. 2. Roller 8, likewise, can be readily exchanged or its radial position adjusted, as well known, for example by an eccentrically located bearing or the like.

Roller train A has been shown in its simplest standard form; it, of course, can also be constructed similarly to the roller train B, with dual support plates, merely in form of a right-for-left reversed mirror image.

Various changes and modifications may be made within the scope of the inventive concept.

I claim:

1. In combination with a printing machine having a plate cylinder (1),
 an ink train system having
 an ink distribution roller means (7, 8);
 two application rollers (10, 11) positioned in circumferentially offset location about the circumference of the plate cylinder, whereby one roller (11) will be located behind the other roller and thereby form an inner roller (11) of the ink train system;
 an ink transfer roller (9) in engagement with both said application rollers (10, 11), and further in engagement with the ink distribution roller means (7, 8);
 and bearing means (21) locating the ink transfer roller in a fixed position on a frame of the machine,
 comprising,
 a first outer support plate (13) pivotally mounted to pivot about the axis of rotation of said bearing means (21), said first outer support plate securing thereon the ink distribution roller means (7, 8);
 a second, inner support plate (14) pivotally mounted to pivot about the axis of rotation of said bearing means independently of pivoting movement of said outer support plate, said second, inner support plate securing thereon the inner roller (11);
 first operating means (16–19) coupled to the first outer support plate (13) to effect and control pivoting movement thereof about the axis of rotation of the transfer roller (9);
 and means to render the inner application roller (11) accessible from behind the outer application roller (10) including second operating means (15, 20) coupled to the second, inner support plate (14) and secured to the first outer support plate (13) to control relative positioning of the inner roller (11) with respect to the plate cylinder (1) while permitting rolling movement about the circumference of the transfer roller (9) upon pivoting or tipping the first, outer plate (13) about the axis of rotation of the transfer roller under command of said first operating means.

2. System according to claim 1, wherein said ink train system further includes an ink supply roller (3) and roller elements (4, 5, 6) applying ink from the ink supply roller (3) to the plate cylinder;
 and wherein said ink distribution roller means (7, 8) comprises an ink distribution roller (7) in engagement with said distribution roller (3) when said outer plate (13) is pivoted for engagement position of the respective ink distribution roller (7) and said ink supply roller (3) with each other.

3. System according to claim 2 wherein said transfer roller (9) comprises a milling roller.

4. System according to claim 1, wherein said ink train system includes an ink supply roller (3);
 and wherein said first operating means comprises adjustable means (17, 18, 19) positioning the ink distribution roller means (7, 8) with respect to said ink supply roller (3) in predetermined location.

5. System according to claim 4, wherein said adjustable means comprises a stop means (18, 19) cooperating with a fixed stop (17) located on the frame of the machine to position the rollers moved upon pivoting movement of the outer plate with respect to the ink supply roller and said plate cylinder in predetermined, adjusted location.

* * * * *

United States Patent [19]

Simeth

[11] **4,399,767**

[45] **Aug. 23, 1983**

[54] **VARNISHING UNIT IN THE DELIVERY UNIT OF A SHEET-FED ROTARY PRINTING PRESS**

[75] Inventor: **Claus Simeth**, Offenbach am Main, Fed. Rep. of Germany

[73] Assignee: **M.A.N.-Roland Druckmaschinen Aktiengesellschaft**, Fed. Rep. of Germany

[21] Appl. No.: **386,656**

[22] Filed: **Jun. 9, 1982**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 374,150, May 3, 1982, abandoned.

[30] **Foreign Application Priority Data**

May 6, 1981 [DE] Fed. Rep. of Germany 3117855

[51] **Int. Cl.**^{3} **B05C 11/00**

[52] **U.S. Cl.** **118/46**; 101/232; 118/236; 118/239; 118/249

[58] **Field of Search** 118/46, 236, 239, 249; 101/232

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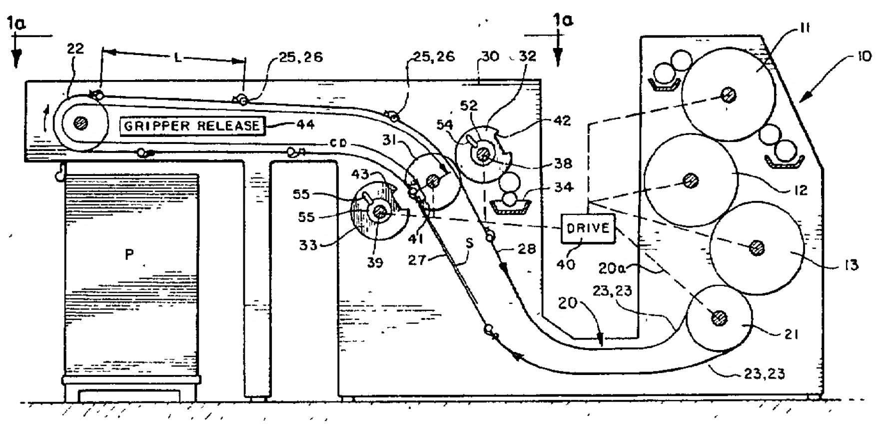
Primary Examiner—Evan K. Lawrence

Attorney, Agent, or Firm—Leydig, Voit, Osann, Mayer & Holt, Ltd.

[57] **ABSTRACT**

An apparatus for varnishing a sheet being fed from a sheet fed printing press into a delivery unit, the sheet being conveyed by an endless loop conveyor made up of a pair of laterally spaced conveyor chains. Cross members extend between the chains at regular intervals carrying grippers for the leading edge of successive sheets. The chains are guided to form a delivery run and a return run spaced apart and generally parallel to one another. An applicator cylinder is journalled between the runs having an axial length which is shorter than the lateral spacing between the chains. A plate cylinder journalled in the frame outside of the return run is in rolling engagement with the applicator cylinder for supplying a varnish film thereto. A backing cylinder journalled in the frame outside of the delivery run is in rolling engagement with the applicator cylinder. The circumference of the cylinders equals the spacing between successive cross members and grippers. The applicator, plate, and backing cylinders have respective longitudinal grooves sufficiently large to provide free passage for the cross members and associated grippers. The cylinders are driven synchronously with the conveyor chains so that a sheet passing on the grippers is engaged between the applicator and backing cylinders for application of varnish to the sheet. The conveyor speed is less than the press speed in a predetermined ratio. The cylinders have a diameter less than the diameter of the cylinders in the associated press unit in the same ratio.

10 Claims, 5 Drawing Figures



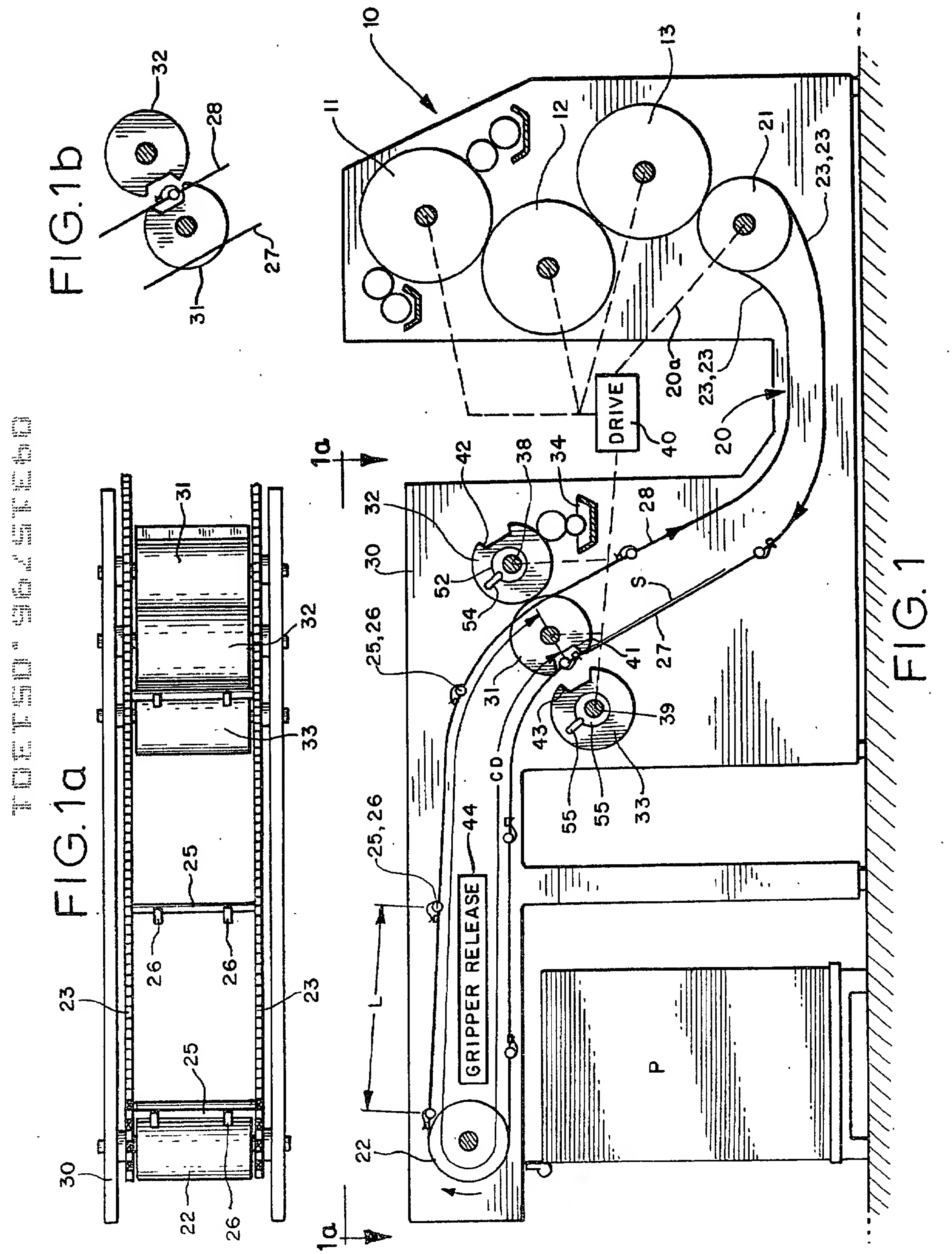


FIG. 1b

FIG. 1a

FIG. 1

FIG. 2

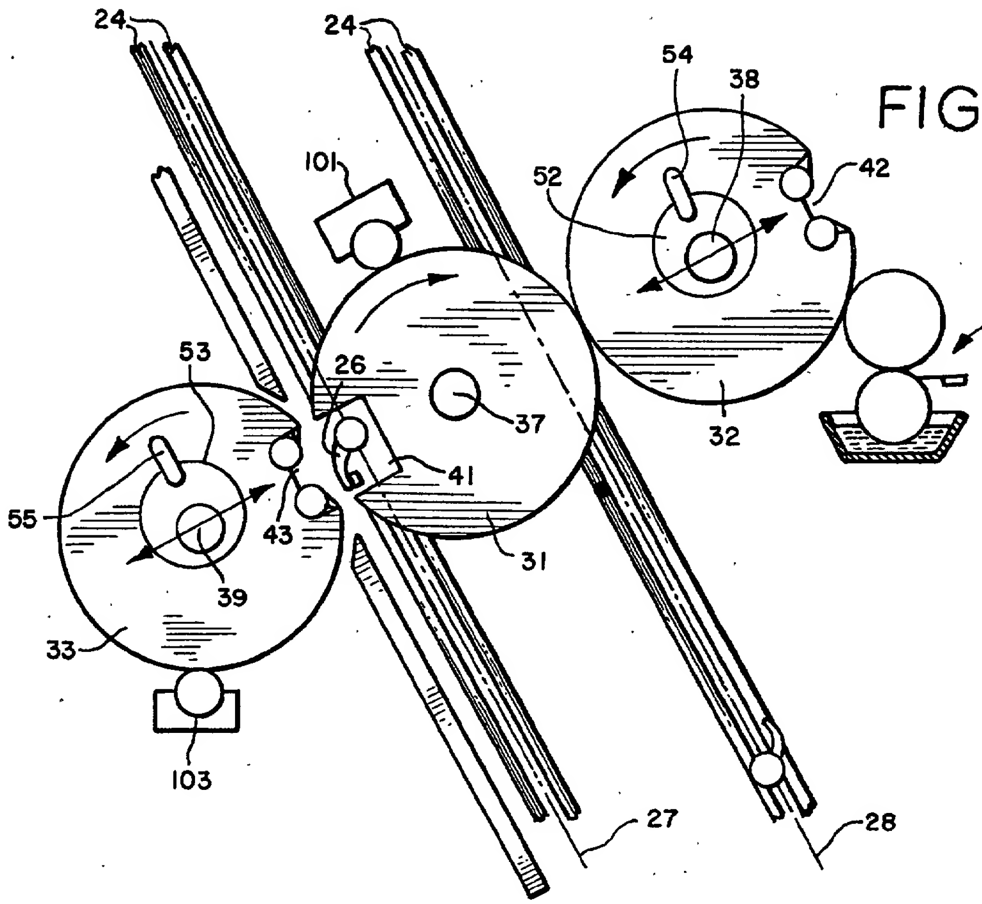

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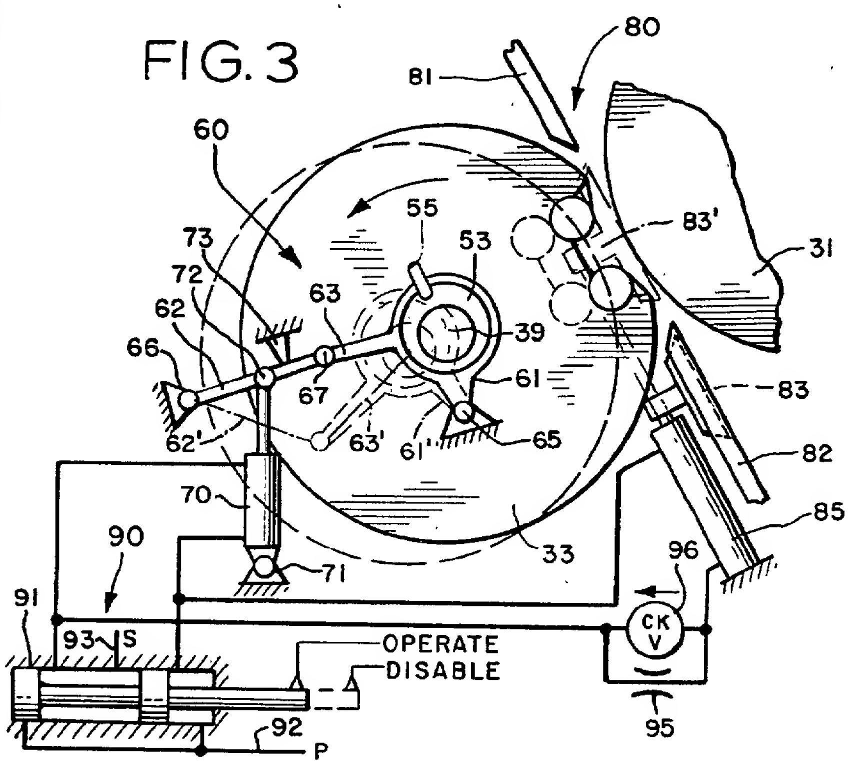
FIG. 3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VARNISHING UNIT IN THE DELIVERY UNIT OF A SHEET-FED ROTARY PRINTING PRESS

This application is a continuation-in-part of application Ser. No. 374,150, filed May 3, 1982, abandoned.

It is known to modify a damping unit in the last printing unit of a printing press to apply varnish to a printed sheet. It is also known to use a separate varnishing unit in the path of the sheets being conveyed from the printing press to the delivery unit.

German Pat. No. 2,020,584 shows application of varnish by the dampening unit of the last printing unit, by a varnishing unit on the last blanket cylinder and by a varnishing unit on a separate sheet guide cylinder. In each case, however, varnishing is at the expense of the last printing unit in the press which must be cut out or modified. An additional printing unit for the application of varnish downstream of the last ink printing unit requires two additional transfer stations, which is quite costly in addition to complicating the construction and maintenance of the machine.

German Pat. No. 2,345,183 describes a varnishing unit which is mounted in the delivery unit instead of in the printing unit. However this requires an additional sheet transfer comprising a transfer and take-off drum with grippers and control means. Again, the machine is quite complicated and costly.

German Pat. No. 1,930,317 teaches the possibility of conveying printed sheets through a number of printing units successively in one gripper operation by means of a transportation system consisting of chains, grippers and guides. However this is a costly system since it acquires large reversing wheels at the ends of the machine to enable the empty run of the transportation system to be returned beneath the printing units.

It is, accordingly, an object of the present invention to provide a simple and readily accessible arrangement for accurate-register varnishing which can be incorporated in the delivery unit of the sheet fed printing press without any appreciable expense in terms of space and material, while the printing units of the machine are not required to be modified or disabled and hence are always available for printing. It is a related object to provide means for achieving accurate-register varnishing which does not require the use of auxiliary transfers by transfer drums of the like and during which the varnishing takes place as a sheet follows a straight line conveyance path.

It is more particularly an object of the invention to provide a varnishing means for use in a delivery which employs a minimum number of parts, which is easily installed and serviced with convenient access, and which is capable of being economically installed in new delivery units or, on a retrofit basis, in units already in the field to provide the advantages of varnishing at lowest possible cost.

It is still another object of the present invention to provide a device of the type described which is highly compact, a device in which both the delivery run and return run of the conveyor have free passage through a groove in the applicator cylinder without necessity for any special synchronizing means, and in which the cylinders are so arranged as to facilitate impression adjustment and throw off.

Other objects and advantages of the invention will become apparent upon reading the attached detailed description and upon reference to the drawings in which:

FIG. 1 is an elevational view, somewhat diagrammatic, of a delivery unit for a printing press incorporating provision for varnishing in accordance with the present invention.

FIG. 1*a* is a partial top view of the delivery unit shown in FIG. 1 looking down along the line 1*a*—1*a* therein.

FIG. 1*b* is a fragment showing free passage of cross member and grippers in the return run.

FIG. 2 is an enlarged view of a portion of FIG. 1.

FIG. 3 is a further enlargement showing the provision for throw-off of the backing cylinder and the simultaneous insertion of a sheet guide segment.

While the invention has been described in connection with a preferred embodiment, it will be understood that I do not intend to be limited to the particular embodiment shown but intend, on the contrary, to cover the various alternative and equivalent constructions included within the spirit and scope of the appended claims.

Turning now to FIG. 1 of the drawings there is shown, in diagrammatic form, a lithographic printing press unit 10 having the usual plate cylinder 11, blanket cylinder 12 and impression cylinder 13. This unit, either acting alone or in tandem with preceding press units, achieves printing on at least one side of the sheet, the sheet being indicated as S. The printing unit 10 discharges into a conveyor 20 having an input drum 21 and output drum 22. The conveyor is formed of a pair of laterally spaced closed loops of conveyor chain 23 which are trained around sprockets on the drums, the chains being guided between the drums along guide rails 24 (see also FIG. 2). Extending between the loops of chain 23 are cross members 25 which are spaced at equal intervals along the entire length of the chain, the cross members carrying pairs of grippers 26 which grip and transport the leading edges of successive sheets. The conveyor chains are supported to form a relatively straight and parallel delivery run 27 leading from the press unit to the pile P and an idle or return run 28.

In accordance with the present invention an applicator cylinder is journalled in the frame 30 of the delivery unit between the runs 27, 28 and having an axial length which is shorter than the lateral spacing between the chains. A plate cylinder journalled in the frame outside of the return run 28 is in rolling engagement with the applicator cylinder. A backing cylinder is journalled in the frame outside of the delivery run 27 for rolling engagement with the applicator cylinder. The circumference of the plate cylinder, applicator cylinder and backing cylinder is the same and equal to the spacing between successive grippers or cross members. At least the applicator cylinder has a longitudinal groove of sufficient size to provide free passage for the cross members and their associated grippers. The cylinders are driven in synchronism with the conveyor chains so that a sheet passing on the grippers is engaged between the applicator and backing cylinder for application of a film of varnish to the face of the sheet.

Thus, referring to FIGS. 1 and 2, an applicator cylinder 31 is journalled in the frame 30 of the delivery unit between the runs 27, 28, the applicator cylinder having an axial length which is shorter than the lateral spacing between the chains (see FIG. 1*a*). For furnishing a film of varnish to the applicator cylinder a plate cylinder 32 is provided, the cylinder being journalled outside of the

return run 28. For applying back up as the sheet is engaged by the applicator cylinder, a backing cylinder 33 is located outside of the delivery run 27.

A varnish fountain 34 acts as a source of varnish for the plate cylinder 32. The plate cylinder 32 carries plates (not shown) which accurately determine the area of the applicator cylinder to which varnish is supplied which, in turn, determines the area over which varnish is applied to the sheet S. The cylinders have respective shafts 37, 38 and 39. As stated, the circumference of each of the cylinders is equal to the spacing L of the successive grippers and cross members. The cylinders and conveyor have a common drive 40.

The conveyor drive connection 20*a* which drives the conveyor 20 is such that the speed of the conveyor is less than press speed in a predetermined ratio. The applicator cylinder 31, plate cylinder 32 and backing cylinder 33 have a diameter and surface speed which is less than the diameter and surface speed of the cylinders in the associated press unit 10 in the same ratio.

In carrying out the invention the applicator cylinder 31 is provided with a groove 41 large enough to provide free passage for the cross members 25 and the grippers 26 thereon in the delivery run 27. The plate cylinder 32 and backing cylinder 33 have mating grooves 42, 43 respectively which are preferably of similar span.

In operation, with the cylinders 31-33 driven in synchronism with the conveyor chains, the cross members and grippers pass freely between the cylinders 31, 33 and a sheet S, passing on the grippers is engaged between the applicator and backing cylinders for application of a film of varnish to the face of the sheet. When the sheet leaves the cylinders 31, 33 it passes to a position above the delivery pile P where the grippers are released by an automatic gripper release mechanism 44 so that the sheet is deposited on the pile. The grippers thus return empty over the upper, or return run 28 of the conveyor.

In accordance with one of the aspects of the invention in its preferred embodiment, the spacing between the delivery run 27 and the return run 28 is less than the diameter of the applicator cylinder 31 so that the applicator cylinder is more or less symmetrically overlapped by each of the runs. The length of the conveyor delivery and return loop defined by the applicator cylinder, and indicated at CD in FIG. 1, is preferably equal to $NL+L/2$ where N is a low integer and L is the gripper-to-gripper spacing so that the cross members and grippers passing in the return run are freely and idly accommodated in the groove 41 of the applicator cylinder and in the mating groove 42 of the plate cylinder which rotate in synchronism with one another. This condition of idle accommodation is shown in FIG. 1*b*. In short, the successive cross members and grippers are accommodated in the groove 41 of the applicator cylinder 31 in both the delivery and return directions resulting in a high degree of compactness of the assembly. The fact that the three cylinders 31, 32 and 33 are of a diameter less than the diameter of the cylinders in the regular printing press unit 10 similarly contributes to compactness.

For the purpose of adjusting the plate cylinder 32 back and forth with respect to the applicator cylinder 31, an eccentric sleeve 52 is provided. Moreover, for adjusting the backing cylinder in a direction toward and away from the applicator cylinder, a similar eccentric sleeve 53 is provided. Such sleeves, having operating handles 54, 55 respectively, are duplicated at the opposite ends of the cylinders. Slight rocking movement of the sleeve 52 increases, or decreases, the impression of the plate cylinder with respect to the applicator cylinder, while rocking the eccentric sleeve 53 of the backing cylinder, on the other hand, provides independent control of the impression between the backing and applicator cylinders.

In accordance with one of the detailed aspects of the present invention the backing cylinder 33 is mounted upon a swingable throw-off linkage for swinging between a working position in which the backing cylinder is in engagement with the applicator cylinder and a retracted position in which the backing cylinder is spaced at least 20 millimeters away from the applicator cylinder. The linkage in the present instance, generally indicated by the numeral 60 (FIG. 3), includes a first arm 61 which mounts the shaft 39 of the cylinder, a second or actuating arm 62, and an intermediate link 63. The arms 61, 62 are pivoted to the frame of the machine at pivots 65, 66 respectively, while the arm 62 is connected to the link 63 by a pivot 67.

For the purpose of swinging the actuator arm 62 from its retracted position to the illustrated working position, a pneumatic or hydraulic actuator 70 is used pivoted to the frame at 71 and pinned, at 72, to the central portion of the arm 62. A limit stop, or reference stop, 73 defines the limit of movement of the arm 62 slightly beyond dead center and hence the degree of extension of the actuator.

When the actuator 70 is in its expanded state, the eccentric sleeve 52 is in working position but subject to rocking movement for control of impression as discussed above. When the actuator 70 is, on the other hand, contracted, the arm 62 is drawn away from the stop 73 and the elements comprising the linkage 60 retreat to the retracted positions 61', 62' and 63' shown by the dotted lines in FIG. 3. Using the geometry shown, the backing cylinder will be withdrawn from the applicator cylinder by an amount which substantially exceeds 20 millimeters.

As a further feature of the invention the throw-off mechanism includes a sheet guide segment with means for interposing the segment between the backing cylinder and the applicator cylinder as the backing cylinder is retracted, so that the sheet is not pressed into engagement with the applicator cylinder and does not receive any varnish. Thus, referring again to FIG. 3, the sheet guide 80 normally consists of two spaced sections 81, 82 having a gap between them enabling the backing and applicator cylinders 31, 33 to engage one another In carrying out the invention a bridging segment 83 is provided mounted on the plunger of an auxiliary actuator 85 so that the segment 83 normally occupies its retracted position but, upon extension of the actuator 85, occupies its bridging position 83' shown by the dotted outline.

The movements of the actuators 70, 85 may be coordinated by connecting them in a hydraulic circuit generally indicated at 90 having a spool valve 91 connected to a source of pressurized fluid 92 and to a sump 93. In the condition of the mechanism illustrated in FIG. 3 the actuator 70 is pressurized for extension and the actuator 85 is pressurized for retraction, which is the operating condition. When it is desired to retract the blanket cylinder, the spool in the valve 91 is shifted into the dotted "disable" position in which the actuator 70 is pressurized for retraction and the actuator 85 is pressurized for extension. When it is desired to retract the backing

cylinder, the spool in the valve **91** is shifted into the dotted "disable" position in which the actuator **70** is pressurized for retraction and the actuator **85** is pressurized for extension. A restriction **95** in the line leading the actuator **85** ensures a time delay in the extension of the guide segment to permit time for the backing cylinder to get out of the way. The restriction **95** is, however, bypassed by a check valve **96** to ensure rapid retraction of the guide segment when the backing cylinder is moving back into its operating position.

The thickness of the film of the varnish applied by the applicator cylinder to the sheet is dependent, in part, upon the surface of the applicator cylinder. A minimum of varnish is applied when the surface of the applicator cylinder is smoothly polished. A maximum is applied when the applicator cylinder has a matt or "screened" surface. In accordance with one of the aspects of the present invention the applicator cylinder has means for alternatively mounting thereon replaceable surface elements of conforming cylindrical shape having (a) a smooth polished surface and (b) a matte surface, respectively. In the simplest aspect of the invention the wrap-around elements may be in the form of a thin metal sheet (not shown) of the wrap-around type, with the ends of the sheet being held by any convenient flexible plate lockup of conventional design (also not shown).

To facilitate clean up, separate washing units **101**, **103** may be mounted for bringing into engagement with the surfaces of the applicator cylinder **31** and a backing cylinder **33**, respectively, it being understood that such washing units are per se well known in the art. In practice the backing cylinder **33** is covered with a resilient blanket which may be substituted by a blanket having a different degree of stiffness, as desired. The term "guide rails" as used herein referes to any means which may be used to guide the conveyor chains along predetermined delivery and return runs.

It will be apparent that the objects of the invention have been amply fulfilled. The varnishing cylinders in the delivery accomplish accurate-register varnishing cheaply, conveniently and compactly saving the expense of a separate varnishing unit. When varnish is not required it is a simple matter to throw the control valve **91** into its "disable" position, protection being automatically provided for the passing sheet.

I claim:

1. An apparatus for varnishing a sheet being fed from a sheet-fed printing press unit into a delivery unit comprising, in combination, a frame, guide rails in the frame, a pair of conveyor chains laterally spaced from one another on the guide rails to form an endless loop conveyor extending from the press unit to a delivery pile, the chains having cross members at regular intervals, grippers at the cross members for gripping the leading edge of a sheet, the guide rails being arranged to form a delivery run and return run spaced apart and generally parallel to one another, an applicator cylinder journalled in the frame in a position in which it is overlapped by each of the runs but having an axial length which is shorter than the lateral spacing between the chains, means supported on the frame outside of the return run and in rolling engagement with the applicator cylinder for supplying a film of varnish thereto, a backing cylinder journalled in the frame outside of the delivery run and in rolling engagement with the applicator cylinder, the circumference of the cylinders being equal to the spacing between the successive cross members and grippers, the applicator cylinder having a longitudinal groove sufficiently large to provide free passage for the cross members and associated grippers in both the delivery run and the return run, means for driving the cylinders in synchronism with the conveyor chains so that a sheet passing on the grippers is engaged between the applicator and backing cylinders for application of varnish to the sheet.

2. An apparatus for varnishing a sheet being fed from a sheet-fed printing press unit into a delivery unit comprising, in combination, a frame, guide rails in the frame, a pair of conveyor chains laterally spaced from one another on the guide rails to form an endless loop conveyor extending from the press unit to a delivery pile, the chains having cross members at regular intervals, grippers at the cross members for gripping the leading edge of a sheet, the guide rails being arranged to form a delivery run and return run spaced apart and generally parallel to one another, an applicator cylinder journalled in the frame between the runs having an axial length which is shorter than the lateral spacing between the chains, means supported on the frame outside of the return run and in rolling engagement with the applicator cylinder for supplying a film of varnish thereto, a backing cylinder journalled in the frame outside of the delivery run and in rolling engagement with the applicator cylinder, the circumference of the cylinders being equal to the spacing between the successive cross members and grippers, the applicator and backing cylinders having respective longitudinal grooves sufficiently large to provide free passage for the cross members and associated grippers, means for driving the cylinders in synchronism with the conveyor chains so that a sheet passing on the grippers is engaged between the applicator and backing cylinders for application of varnish to the sheet.

3. The combination as claimed in claim **1** or in claim **2** in which the speed of the conveyor is less than press speed in a predetermined ratio, the cylinders being of the same diameter and surface speed, which diameter and surface speed is less than the diameter and surface speed of the cylinders in the associated press unit in the same ratio.

4. The combination as claimed in claim **1** or in claim **2**, the spacing between the delivery run and the return run being somewhat less than the diameter of the applicator cylinder so that the applicator cylinder is symmetrically overlapped by each of the runs, the length of the conveyor delivery and return loop defined by the applicator cylinder being equal to NL+L/2 where N is a low integer and L is the gripper-to-gripper spacing so that cross members and grippers passing in the return run are idly accommodated in the groove of the applicator cylinder.

5. The combination as claimed in claim **1** or in claim **2** in which the means for supplying a film of varnish includes a plate cylinder.

6. The combination as claimed in claim **1** or in claim **2** in which the backing cylinder is mounted upon a swingable throw-off linkage including a toggle for swinging between a working position in which the backing cylinder is in engagement with the applicator cylinder with the toggle on center and a retracted position in which the backing cylinder is spaced at least 20 millimeters away from the applicator cylinder.

7. The combination as claimed in claim **1** or in claim **2** in which the backing cylinder is mounted upon a swingable throw-off linkage including a toggle for swinging between a working position in which the

backing cylinder is in engagement with the applicator cylinder with the toggle on center and a retracted position in which the backing cylinder is spaced at least 20 millimeters away from the applicator cylinder and in which the throw-off mechanism includes a sheet guide segment with means for interposing the segment between the backing cylinder and the applicator cylinder as the backing cylinder is retracted so that the sheet is held safely away from the applicator cylinder free of transfer of any varnish therefrom.

8. The combination as claimed in claim 1 or claim 2 in which the applicator cylinder has a smooth polished surface.

9. The combination as claimed in claim 1 or claim 2 in which the applicator cylinder has a matte surface.

10. The combination as claimed in claim 1 or claim 2 in which the applicator cylinder has means for alternatively mounting thereon replaceable surface elements of conforming cylindrical shape having (a) a smooth polished surface and (b) a matte surface, respectively.

* * * * *

32

United States Patent [19]

Matsuno et al.

[11] Patent Number: 4,501,223

[45] Date of Patent: Feb. 26, 1985

[54] COATING APPARATUS

[75] Inventors: Sadayuki Matsuno, Yokohama; Hiroshi Itoh, Tokyo; Isamu Nishikawa, Yokohama; Tatsuo Awazu, Zushi; Toshio Matsunaga, Tokyo; Yoshitaka Kitaoka; Goro Sugimoto, both of Yokohama; Hiroki Nishinaka, Amagasaki, all of Japan

[73] Assignee: Hitachi Zosen Corporation, Japan

[21] Appl. No.: 591,400

[22] Filed: Mar. 21, 1984

[30] Foreign Application Priority Data

Nov. 30, 1983 [JP] Japan 58-227742

Nov. 30, 1983 [JP] Japan 58-227743

[51] Int. Cl.³ B05C 7/00

[52] U.S. Cl. 118/668; 118/305; 118/323

[58] Field of Search 118/668, 305, 323

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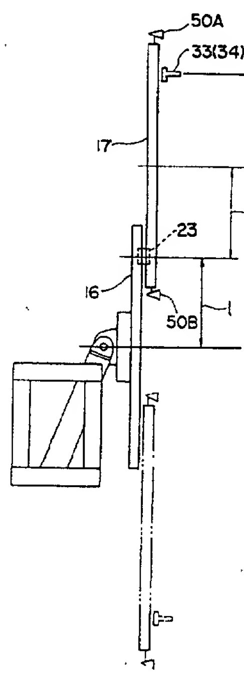
Primary Examiner—Shrive P. Beck

Attorney, Agent, or Firm—Barnes, Kisselle, Raisch, Choate, Whittemore & Hulbert

[57] ABSTRACT

A coating apparatus comprising a support assembly, a support moving mechanism for pivotally moving the support assembly about a horizontal axis, an applicator supported by the support assembly upwardly and downwardly movably, a position detector for detecting the raised or lowered position of the applicator, a pair of distance sensors attached to the support assembly and arranged one above the other at a distance for detecting the distance from the work surface to be coated, and a control unit connected to the position detector and to the distance sensors for causing the support moving mechanism to pivotally move the support assembly in response to detection signals from one of the distance sensors closer to the applicator to hold the applicator at a substantially constant distance from the work surface. Even when curved in the direction of the height, the work surface can be coated uniformly because the substantially constant distance is maintained between the applicator and the work surface.

6 Claims, 12 Drawing Figures



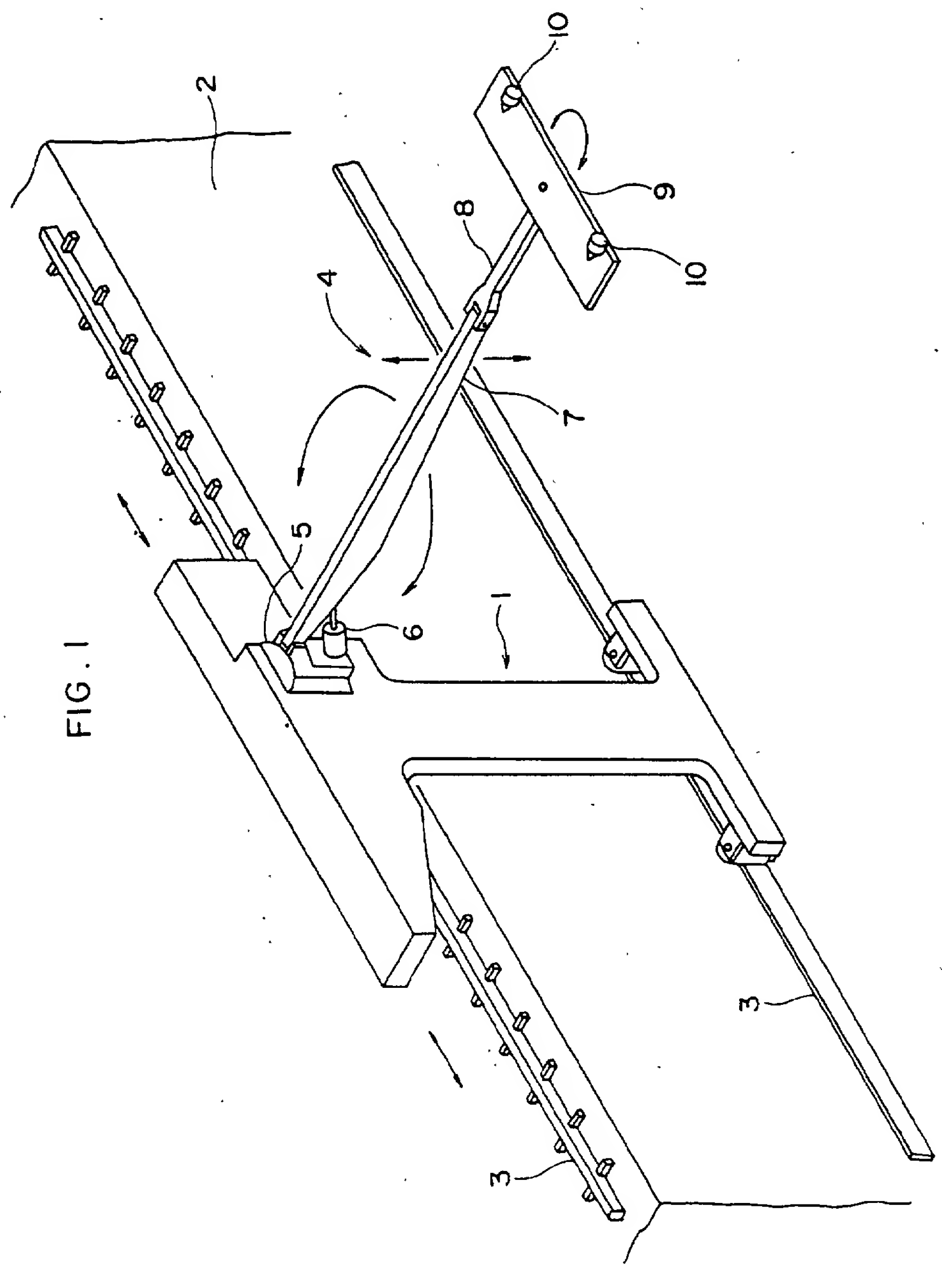


FIG. 1

FIG. 2

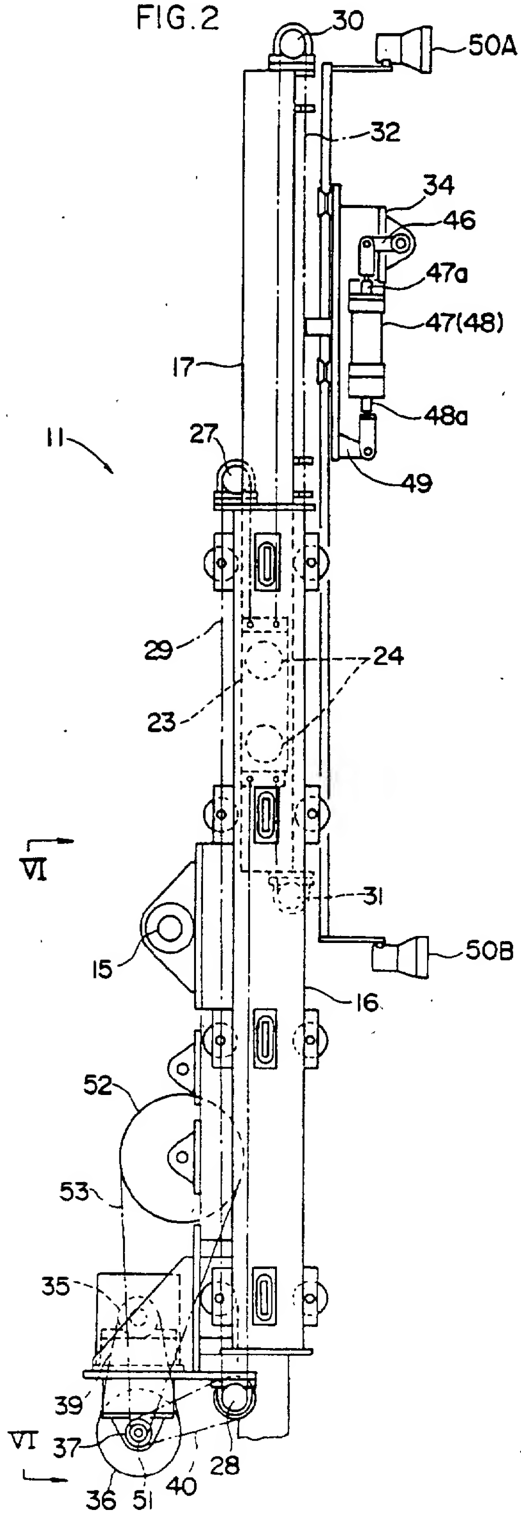
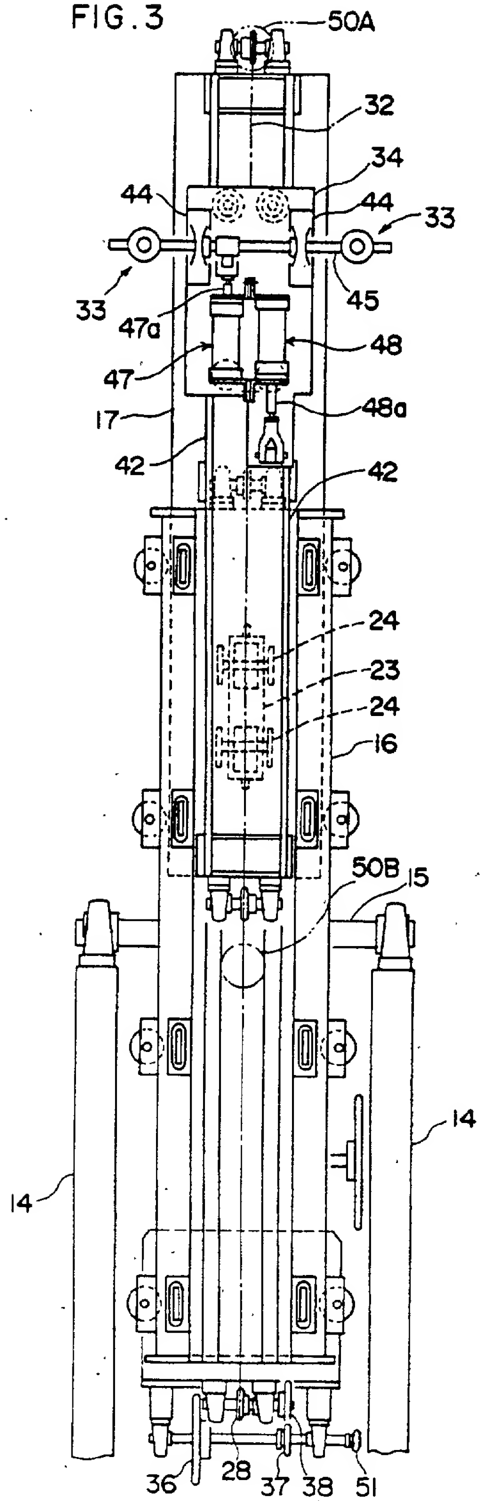

30
50A
32
34
46
47a
47(48)
17
48a
11
27
49
29
24
23
VI
31
15
50B
16
52
53
35
39
VI
37
28
36
51
40

FIG. 3


50A
32
34
44
44
33
33
45
47a
48
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48a
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24
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50B
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38
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FIG. 4

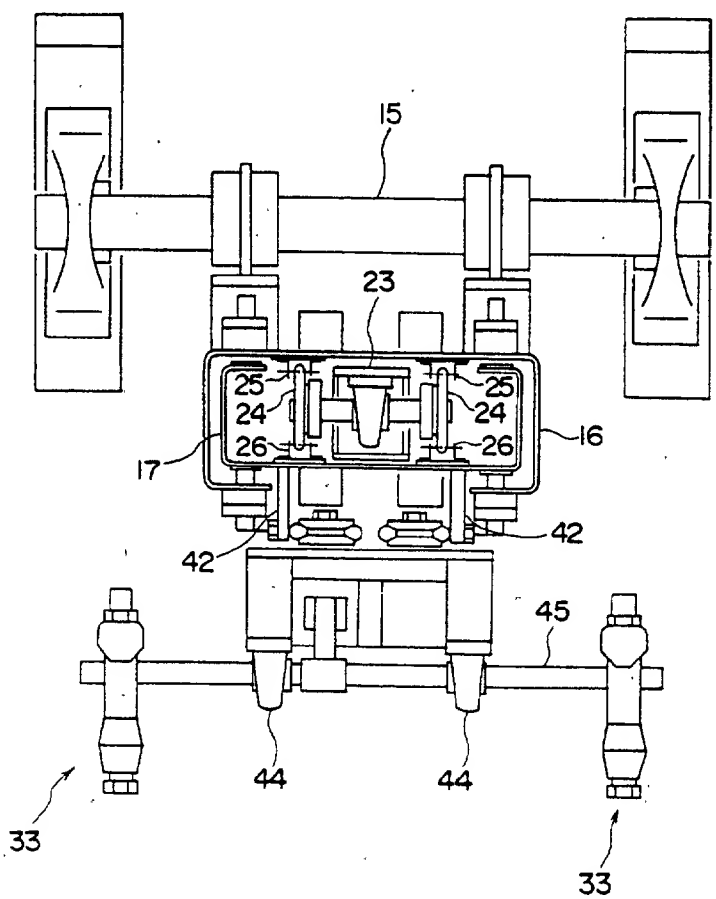


FIG. 5

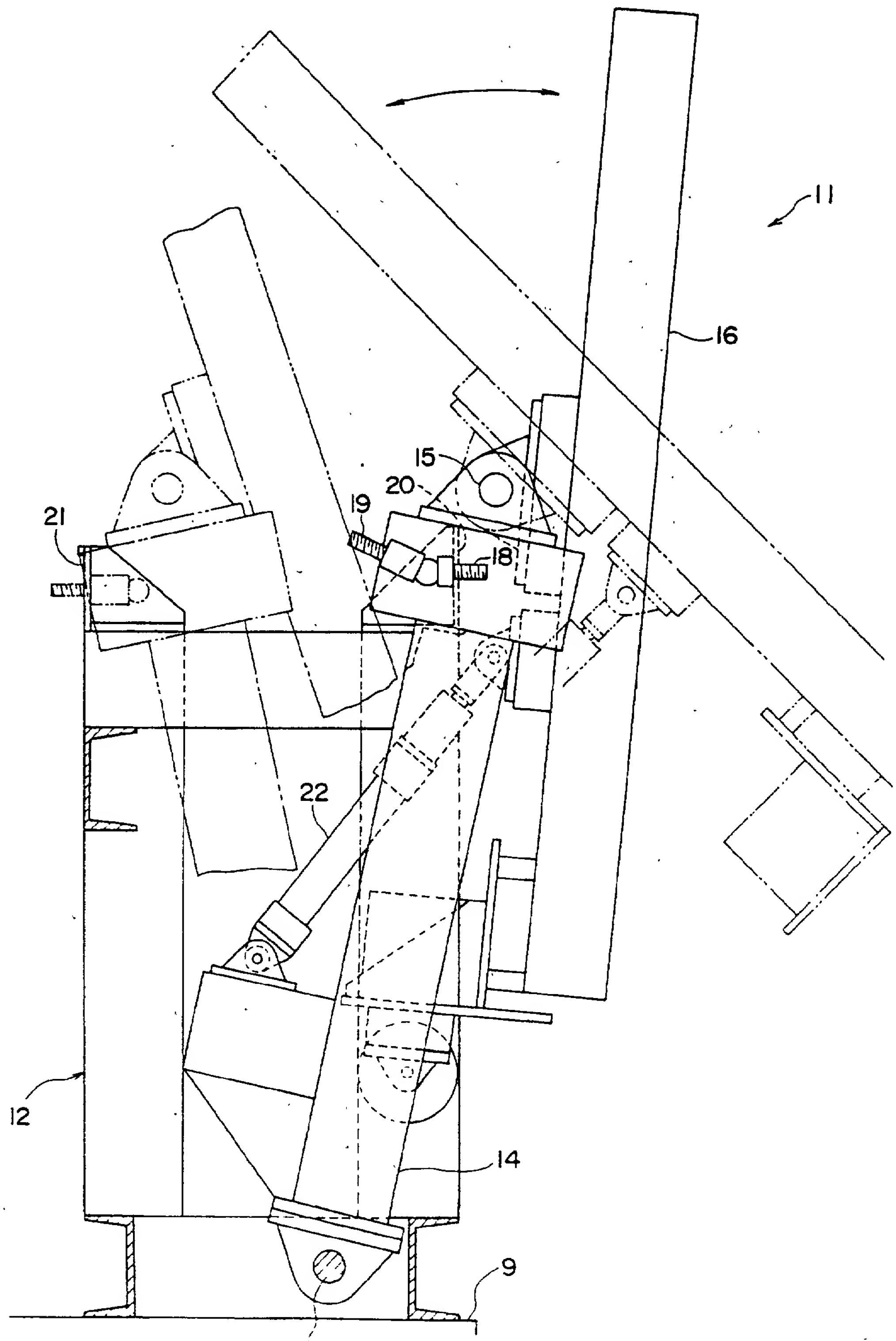


FIG. 6

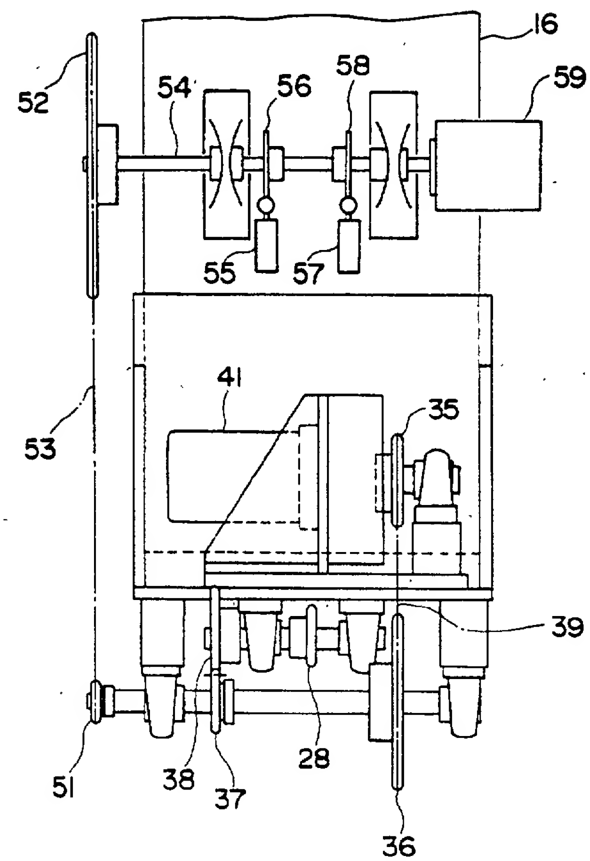
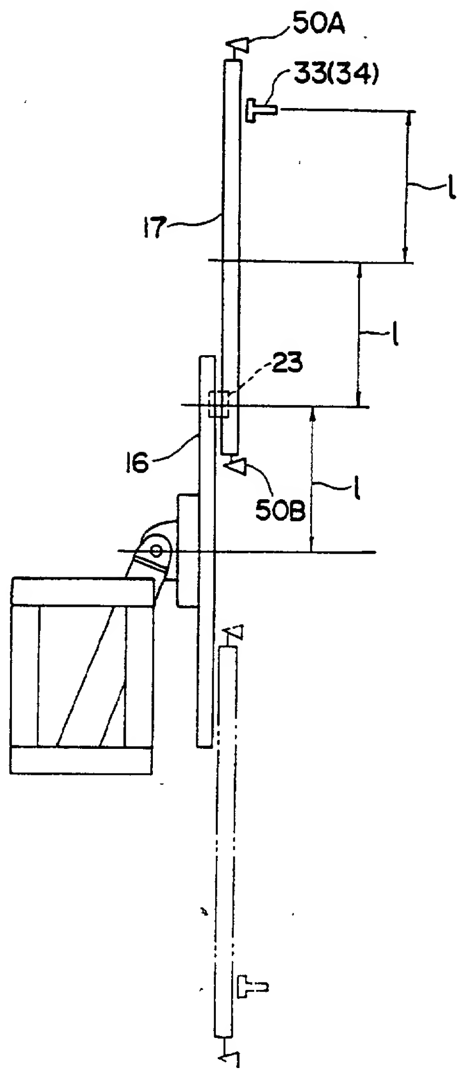


FIG.7



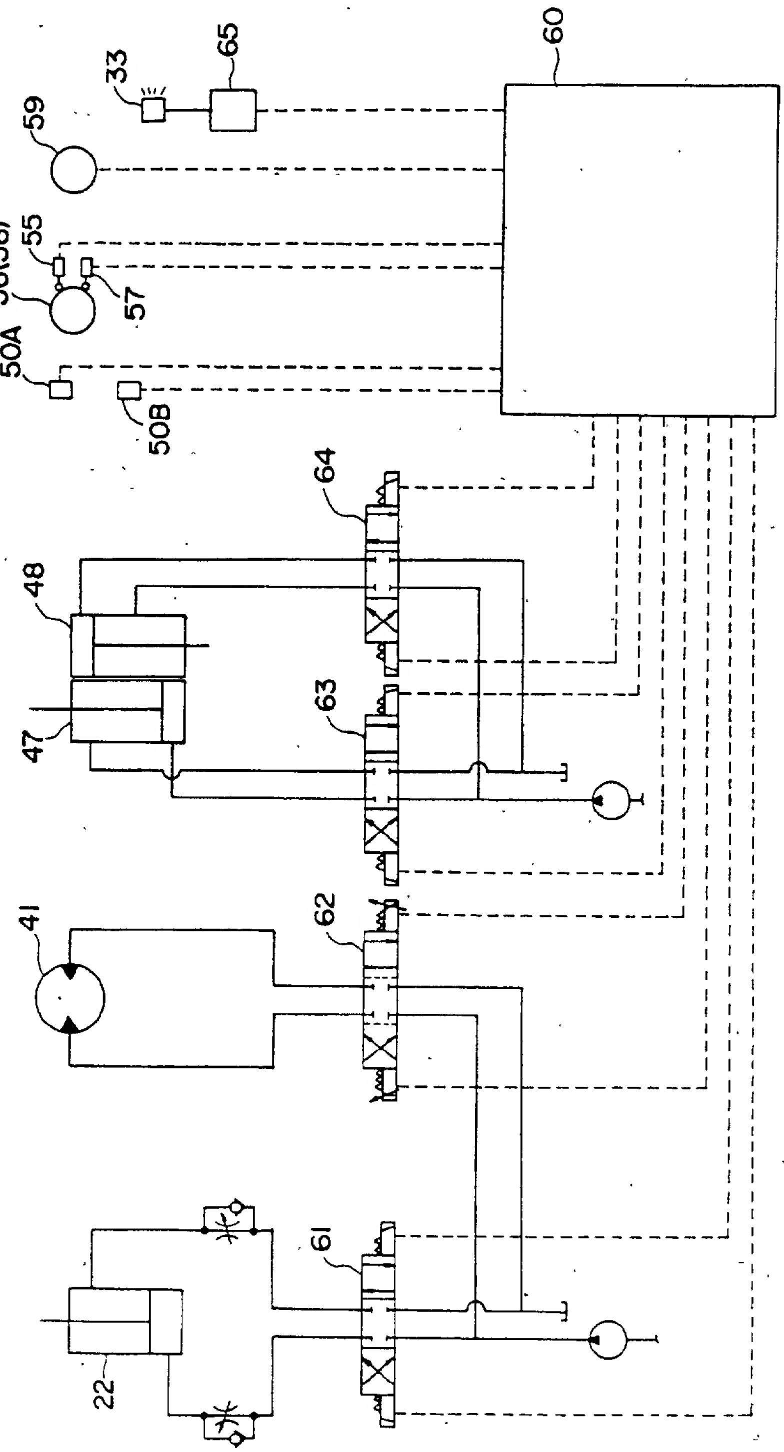


FIG. 8

FIG. 9

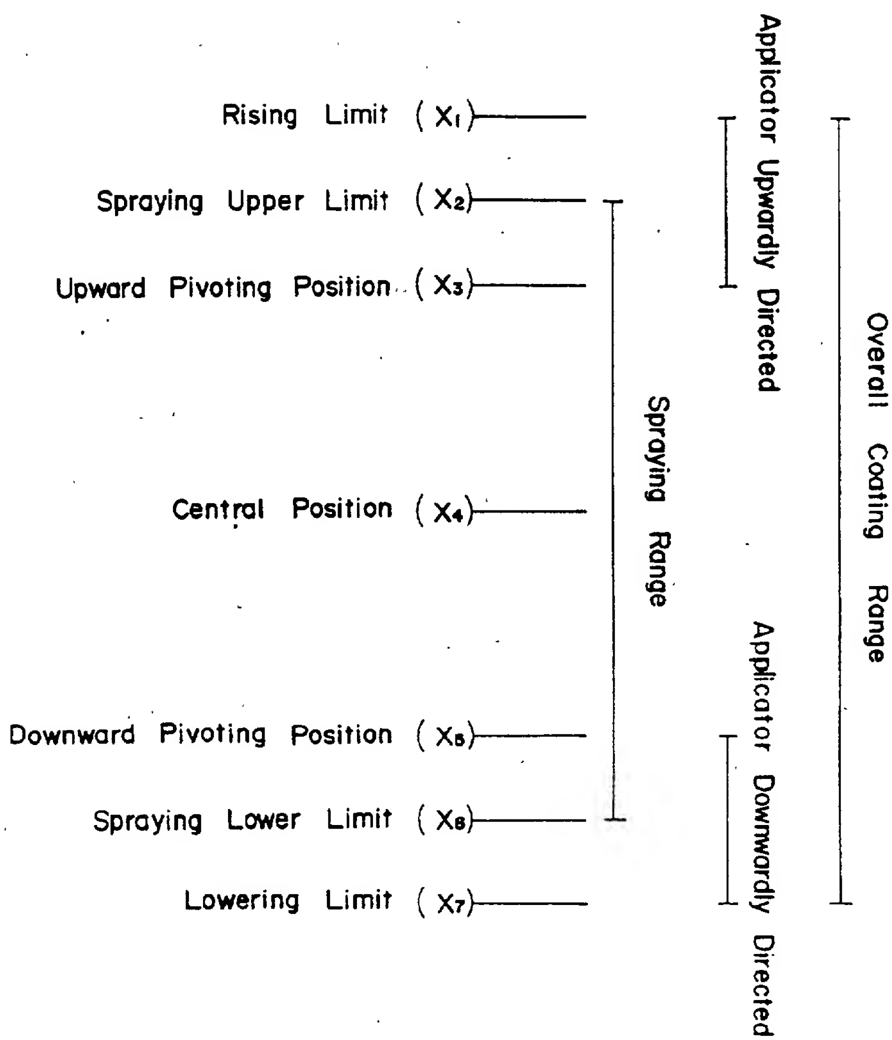
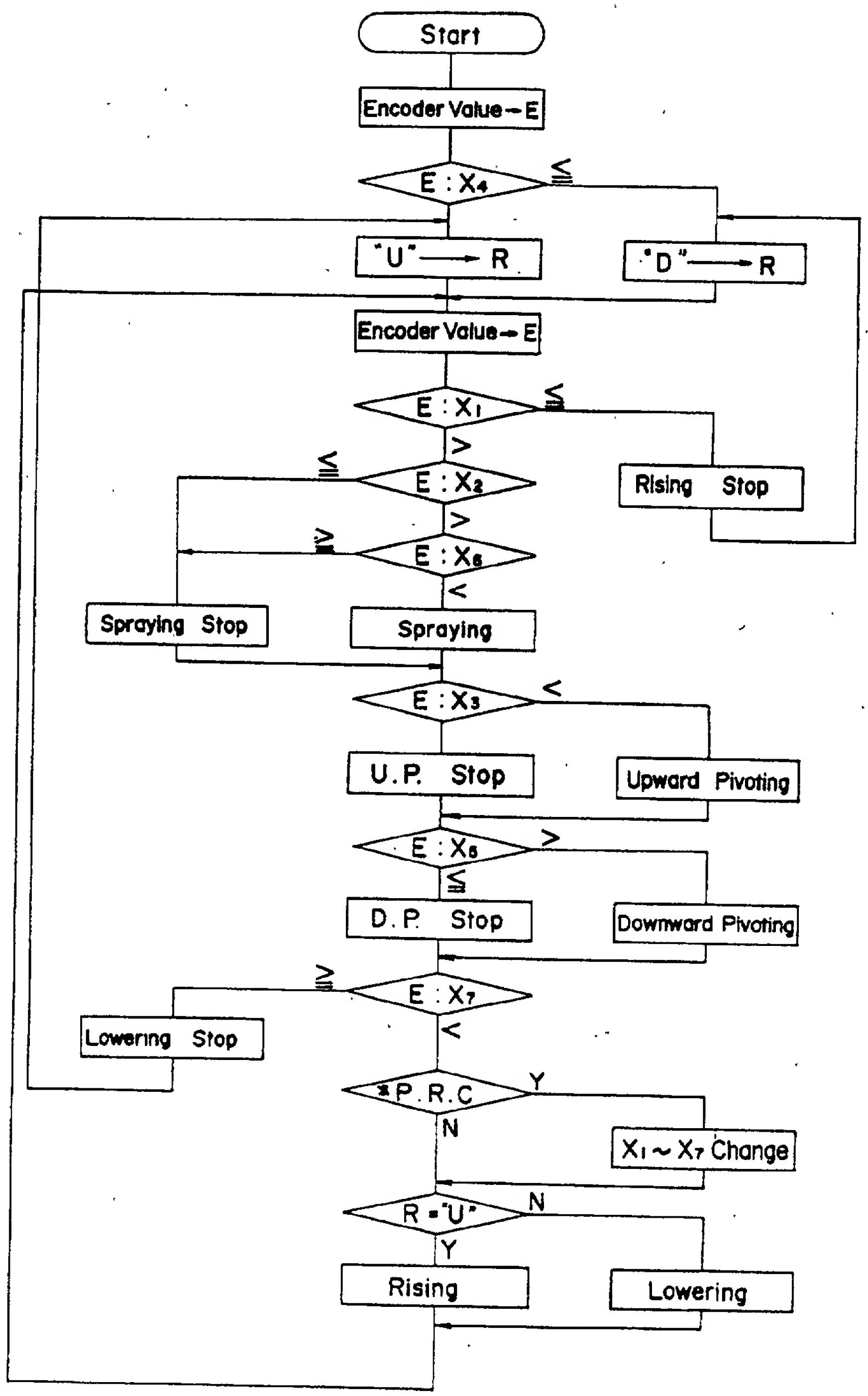

Rising Limit (X1)
Spraying Upper Limit (X2)
Upward Pivoting Position (X3)
Central Position (X4)
Downward Pivoting Position (X5)
Spraying Lower Limit (X6)
Lowering Limit (X7)
Spraying Range
Applicator Upwardly Directed
Applicator Downwardly Directed
Overall Coating Range

FIG. 10



* Coating Range Change

FIG. 11

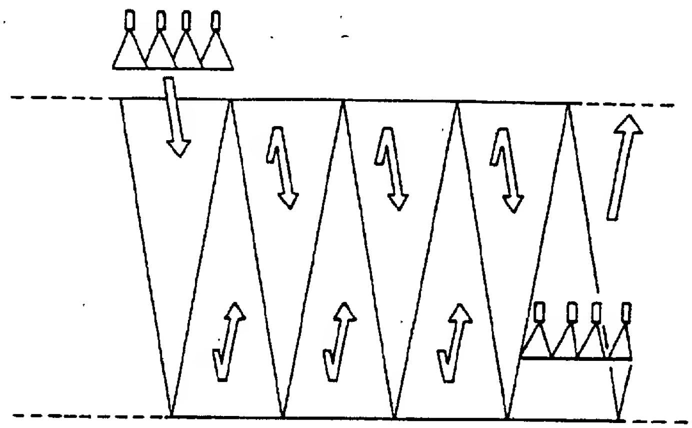
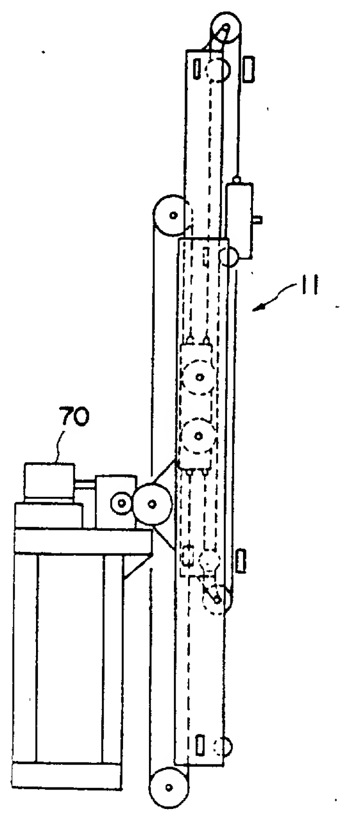


FIG. 12



COATING APPARATUS

The present invention relates to a coating apparatus, and more particularly to a coating apparatus suitable for applying a coating composition to the shell plating of ships during docking.

Laid-Open UK patent application GB 2110647A discloses a coating apparatus including support means which is mounted on a running truck horizontally movable along the surface to be treated and which supports an applicator upwardly or downwardly movably. The support means is pivotally movable about a horizontal axis by a device which is controlled by an operator, whereby the applicator can be held somewhat at a constant distance from the work surface which is curved in the direction of height. While being reciprocated between an upper limit position and a lower limit position, the applicator sprays a coating composition onto the work surface for coating.

However, because the support means moving device is operated by the worker, the known coating apparatus requires skill in holding the applicator at a constant distance from the work surface, while even a skilled worker has difficulties in maintaining the constant distance at all times between the work surface and the applicator which is continuously moved upward and downward, thus failing to assure uniform coating.

An object of the present invention is to provide an apparatus by which even curved surfaces can be coated uniformly and full-automatically.

To fulfill this object, the present invention provides a coating apparatus comprising support means, support moving means for pivotally moving the support means about a horizontal axis, an applicator holder supported by the support means upwardly and downwardly movably and supporting applicator means, holder drive means for moving the applicator holder upward and downward, position detecting means for detecting the raised or lowered position of the applicator holder or the applicator means, a pair of distance detecting means attached to the support means and arranged one above the other at a distance for detecting the distance from the work surface to be coated, and control means connected to the position detecting means and to the distance detecting means for causing the support moving means to pivotally move the support means in response to detection signals from one of the distance detecting means closer to the applicator means to maintain a substantially constant distance between the applicator means and the work surface.

Various features and advantages of the present invention will be readily understood from the embodiments to be described below with reference to the accompanying drawings, in which:

FIG. 1 is an overall perspective view showing a coating apparatus embodying the invention;

FIG. 2 is a side elevation showing support means included in the coating apparatus and provided with an applicator;

FIG. 3 is a front view showing the support means;

FIG. 4 is a plan view of the support means;

FIG. 5 is a fragmentary enlarged view of the support means;

FIG. 6 is a view showing the support means as it is seen in the direction of line VI—VI in FIG. 2;

FIG. 7 is a diagram for illustrating the upward or downward movement of the applicator;

FIG. 8 is a diagram showing the control circuit of the coating apparatus;

FIG. 9 is a diagram showing operating positions of the applicator;

FIG. 10 is a flow chart showing a control process for coating operation;

FIG. 11 is a diagram showing coating cycles; and

FIG. 12 is a fragmentary side elevation showing another embodiment of the invention.

With reference to FIG. 1, a truck 1 is adapted to run horizontally alongside a hull in a dock over the entire length of the hull by being guided by upper and lower rails 3 extending along a side wall 2 of the dock. The running truck 1 is provided with a crane 4. The crane 4 comprises a rotary support 5 mounted on an upper portion of the truck 1 and rotatable about a vertical axis, a pivotal arm 7 supported by the rotary support 5 and pivotally movable about a horizontal axis by a hydraulic cylinder 6, and a rotatable plate 9 supported by a horizontal arm 8 which is held always in a horizontal position to the free end of the pivotal arm 7, the plate 9 being rotatable about a vertical axis. Ultrasonic sensors 10 mounted on opposite ends of the rotatable plate 9 are used for causing the plate 9 to follow the horizontal curve of the outer side surface of the hull.

With reference to FIGS. 2 to 8, support means 11 is mounted on the rotatable plate 9. The support means 11 chiefly comprises a pair of pivotal rods 14 rotatably attached by a horizontal pivot 13 to opposite sides of the lower end of a frame 12 fixedly mounted on the rotatable plate 9, a first support member 16 rotatably connected to the free ends of the pivotal rods 14 by a horizontal pivot 15 and in the form of a channel member which is elongated generally vertically, and a second support member 17 supported by the first support member 16 movably longitudinally thereof and similarly in the form of a channel member which is elongated generally vertically.

Each of the pivotal rods 14 is fixedly provided at its upper end with a front bolt 18 and a rear bolt 19 which extend away from each other. When the front bolt 18 is inserted through a hole formed in a front bracket 20 at the upper end of the frame 12, with an unillustrated nut screwed on the bolt, the pivotal rod 14 can be retained in a forwardly inclined position (shown in solid lines in FIG. 5). When the rear bolt 19 is inserted through a hole formed in a rear bracket 21 at the upper end of the frame 12, with an unillustrated nut screwed on the bolt, the pivotal rod 14 can be held in a rearwardly inclined position (shown in phantom lines in FIG. 5).

A hydraulic cylinder 22 is provided between the pivotal rod 14 and the first support member 16. The first support member 16 is pivotally movable with the second support member 17 by operating the hydraulic cylinder 22.

A movable member 23 is provided between the first support member 16 and the second support member 17 and has engaging wheels (such as sprockets) 24. First and second engaging rails 25, 26 are attached to the opposed faces of the support members 15, 16, respectively. The engaging wheels 24 on the movable member 23 are in engagement with these rails 25, 26. Connected to opposite ends of the movable member 23 are a first roller chain 29 which is reeved around sprockets 27, 28 mounted on opposite ends of the first support member 16 and a second roller chain 32 which is reeved around sprockets 30, 31 on opposite ends of the second support member 17. The second roller chain 32 is connected

also to an applicator holder 32 carrying applicators 33. The sprocket 28 at the lower end of the first support 16 is coupled through sprockets 35 to 38 and chains 39, 40 to a hydraulic motor 41 fixed to the first support member 16. Accordingly when the motor 41 moves the movable member 23 a distance l relative to the first support member 16 as seen in FIG. 7, the second support member 17 moves the same distance l in the same direction relative to the movable member 23, and at the same time, the holder 34, i.e., the applicator 33 attached thereto, move the same distance l in the same direction relative to the second support member 17. In other words, the applicators 33 move three times the distance of movement of the movable member 23.

The holder 34 is movable along a pair of guide rails 42 fixed to the second support member 17. The applicators 33 (such as spray guns for a coating composition) are fixed to a horizontal rotary shaft 45 supported by bearings 44 on the holder 34. A first air cylinder 47 has a piston rod 47a which is connected to the rotary shaft 45 by a link 46. Fixed to the first air cylinder 47 is a second air cylinder 48 having a piston rod 48a which extends in a direction opposite to the piston rod 47a. The piston rod 48a is rotatably connected to a bracket 49 on the holder 34. The applicators 33 are adapted to be brought to their pivoted central position when the piston rod 47a of the first air cylinder 47 is retracted, with the piston rod 48a of the second air cylinder 48 extended. Accordingly, when the piston rod 47a of the first cylinder 47 is extended, the applicators 33 are pivoted downward, while the retraction of the piston rod 48a of the second cylinder 48 pivotally moves the applicators 33 upward.

Upper and lower ultrasonic sensors 50A, 50B for detecting the distance from the side outer surface of the hull (work surface to be coated) are attached to the upper and lower ends of the second support member 17. Further as seen in FIG. 6, the first support member 16 is provided with an input shaft 54 which is coupled through sprockets 51, 52 and a chain 53 to the hydraulic motor 41 for moving the movable member 23 upward or downward. The sprocket 51 is driven by the motor 41 through the sprockets 35, 36 and chain 39. Mounted on the midportion of the input shaft 54 are a first cam plate 56 for actuating a first limit switch 55 for detecting that the applicators 33 are positioned above the central position in the range of travel thereof, and a second cam plate 58 for actuating a second limit switch 57 for detecting that the applicators 33 are below the central position. A rotary encoder 59 is mounted on one end of the input shaft 54 for detecting the position of the applicator 33 during the travel thereof.

As seen in FIG. 8, the signals from the sensors 50A, 50B, the limit switches 55, 57 and the encoder 59 are all fed to a central processing unit (CPU) 60. In response to such signals, the CPU 60 controls the hydraulic cylinder 22, hydraulic motor 41, air cylinder 47 and air cylinder 48 via electromagnetic change-over valves 61 to 64, respectively, and also controls a coating composition feeder 65 for the applicators 33.

With the coating apparatus of the above construction, the first support member 16, namely, the support means 11, is controlled by the hydraulic cylinder 22 in the following manner. The first and second limit switches 55, 57 feed signals to the CPU 60, which checks whether the applicators 33 are positioned above or below the central position of the path of travel thereof. For example when the applicators 33 are positioned above the central position, the distance signal from the first sensor 50A is compared with a preset distance value. For example if they are found to be away from the hull side outer surface by too large a distance, a signal is given to the electromagnetic change-over valve 61 of the cylinder 22 to bring the first sensor 50A, i.e., the applicators 33, to a position at the preset distance from the outer surface, whereby the means 11 is inclined forward. If the applicators 33 are positioned too close to the hull outer surface, a signal is of course delivered to the valve 61 for moving them away from the hull. Further when the applicators 33 are located below the central position, the second sensor 50B functions to control the support means in the same manner as above. In this way, a substantially constant distance is maintained between the applicators 33 and the side outer surface of the hull over the entire path of travel of the applicators. This eliminates irregularities in the coating that could result from variations in the spraying distance.

The pivotal movement of the applicators 33 is controlled in the manner to be described below with reference to FIG. 9. Along the path of upward-downward movement of the applicators 33, rising limit position, spraying upper limit position, upward pivoting position, central position, downward pivoting position, spraying lower limit position and lowering limit position are set for the applicators from above downward in the order mentioned. Encoded values corresponding to these positions are stored in a memory of the CPU 60 as X1 to X7. Under the control of the CPU 60, a coating composition is sprayed from the applicators 33 within the range of X2 to X6. Between X1 and X3, the applicators 33 are directed upward within an upward angular range of 45 degrees. Between X5 and X7, the applicators 33 are directed upward within a downward angular range of 45 degrees. The applicators 33 are operated in this mode by controlling the hydraulic motor 41, the air cylinders 47, 48 and the composition feeder 65. Accordingly, between X2 and X3, as well as between X5 and X6, the coating composition is sprayed from the applicators 33 while they are being pivoted at all times. The coating composition is therefore applicable uniformly over the entire coating range without producing any coat of increased thickness in the vicinity of the rising upper limit position or the lowering limit position.

Actual coating sequence will be described below chiefly with reference to FIGS. 9 and 10. When the start button (not shown) is depressed, an encoder value E representing the position where the applicators 33 are then located is fed to the CPU 60 and compared with X4. If the encorder value E is greater than X4, i.e., if the applicators are positioned below the central position; an instruction for lowering mode D is set in a register R in the CPU 60, causing the applicator 33 to start lowering. When the position of the applicators 33, i.e., the encorder value E, is in the range of X2 to X6, a signal is given to the feeder 65 to initiate application of the coating composition. During the descent of the applicators 33, the encoder value E matches X5, whereupon the CPU 60 feeds to the first air cylinder 47 a signal for pivoting the applicators 33 downward. The applicators 33 are pivotally moved downward from the usual coating posture. When the encoder value E thereafter matches X6, a coating intrruption signal is sent to the feeder 65 to discontinue the coating operation. The applicators 33 further reach the lowering limit position, with a match between the encoder value E and X7,

whereupon a stop signal is emitted to discontinue the decent and downward pivotal movement of the applicators 33. The mode now changes to rising mode U, whereupon the applicators 33 start to rise and are pivoted upward by the first air cylinder 47 (although still directed downward). When the encoder value E becomes identical with X6, coating operation is resumed. As the applicators 33 further rise, the encoder value E matches X5. The applicators 33 are returned to the usual coating posture and brought out of pivotal movement. In this state, the applicators 33 rise to the position of X3 while spraying the composition. At the position of X3, the CPU 60 emits a signal for operating the second cylinder 48, initiating the applicators 33 into upward pivotal movement. At the position of X2, the coating operation is discontinued, and at the position of X1, the applicators 33 stop rising and moving pivotally upward. The applicators 33 thereafter start to descend again in the same manner as above for continual coating operation. While the applicators 33 move upward and downward in reciprocation, the truck 1 (FIG. 1) carrying the support means 11 on the crane 4 continuously moves horizontally. Accordingly the applicators 33 spray the composition in a zigzag fashion as seen in FIG. 11 (showing four spray guns).

Based on the distance measured by the sensors 10 (FIG. 1), the applicators 33 are caused to follow the curve of the outer surface of the hull longitudinally thereof by the crane 4, which is controlled of course by the CPU 60 or other control means connected to the CPU 60.

The support means 11 may be pivoted by a hydraulic or electric stepping motor 70 as shown in FIG. 12.

What is claimed is:

1. A coating apparatus comprising support means, support moving means for pivotally moving the support means about a horizontal axis, an applicator holder supported by the support means upwardly and downwardly movably and supporting applicator means, holder drive means for moving the applicator holder upward and downward, position detecting means for detecting the raised or lowered position of the applicator holder or the applicator means, a pair of distance detecting means attached to the support means and arranged one above the other at a distance for detecting the distance from the work surface to be coated, and control means connected to the position detecting means and to the distance detecting means for causing the support moving means to pivotally move the support means in response to detection signals from one of the distance detecting means closer to the applicator means to maintain a substantially constant distance between the applicator means and the work surface.

2. A coating apparatus as defined in claim 1 wherein the applicator means is mounted on the holder and pivotable about a horizontal axis by applicator pivoting means, the control means being adapted to cause the pivoting means to pivotally move the applicator means upward upon the applicator means reaching a predetermined raised position and to cause the pivoting means to pivotally move the applicator means downward upon the applicator means reaching a predetermined lowered position.

3. A coating apparatus as defined in claim 1 wherein the position detecting means comprises a rotary encoder coupled to the holder drive means.

4. A coating apparatus as defined in claim 1 wherein the support means comprises a first support member elongated in the upward-downward direction and having first engaging rail means and a second support member supported by the first support member movably longitudinally thereof and having second engaging rail means in opposed relation to the first engaging rail means, the applicator means being supported by the second support member upwardly and downwardly movably, the holder drive means including a movable member having engaging wheel means engageable with the two rail means without sliding, means for moving the second support member relative to the movable member by moving the movable member relative to the first support member and means for converting the movement of the second support member relative to the movable member to a movement, equivalent thereto in distance and direction, of the applicator means relative to the second support member.

5. A coating apparatus as defined in claim 1 wherein the support means is attached by a crane to a running truck movable horizontally, and the crane comprises a rotary support mounted on the running truck rotatably about a vertical axis, a pivotal arm having one end supported by the rotary support rotatably about a horizontal axis and pivotally movable by cylinder means, a horizontal arm connected at its one end to the other end of the pivotal arm rotatably about a horizontal axis and held in a horizontal position at all times and a rotatable plate connected to the other end of the horizontal arm rotatably about a vertical axis and having the support means mounted thereon.

6. A coating apparatus as defined in claim 5 wherein the rotatable plate is provided at its opposite ends with a pair of distance detecting means for detecting the distance between the rotatable plate and the work surface.

* * * * *

United States Patent [19]

Ito

[11] **Patent Number: 4,524,712**

[45] **Date of Patent: Jun. 25, 1985**

[54] **VARNISH COATER FOR PRINTED PRODUCT**

[75] Inventor: **Kiyoshi Ito, Chiba, Japan**

[73] Assignee: **Komori Printing Machinery Co., Ltd., Tokyo, Japan**

[21] Appl. No.: **576,219**

[22] Filed: **Feb. 2, 1984**

[30] **Foreign Application Priority Data**

Feb. 3, 1983 [JP] Japan 58-16602

[51] **Int. Cl.**³ **B05C 1/02**

[52] **U.S. Cl.** **118/46**; 118/249; 118/236; 118/262; 101/352

[58] **Field of Search** .... 118/46, 203, 262, 696, 118/699, 704, 249, 236; 101/350, 351, 352, 416 B

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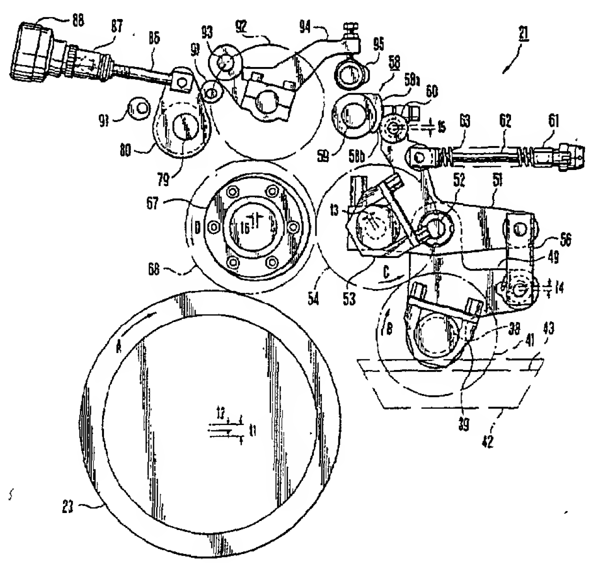
Primary Examiner—John P. McIntosh

Attorney, Agent, or Firm—Blakely, Sokoloff Taylor & Zafman

[57] **ABSTRACT**

In a varnish coater for a printed product, a blanket cylinder and a form roller are respectively supported by eccentric bearings to throw on/off the blanket cylinder with respect to the form roller and an impression cylinder and throw on/off the form roller with respect to the blanket cylinder, and rollers provided in the eccentric bearings of the form roller are brought by biasing means into tight contact with the cam surfaces of cams pivoted by pivot means so as to simplify adjustment of a contact pressure of the form roller with respect to the blanket cylinder at the throw-on and -off positions of the blanket cylinder.

5 Claims, 6 Drawing Figures



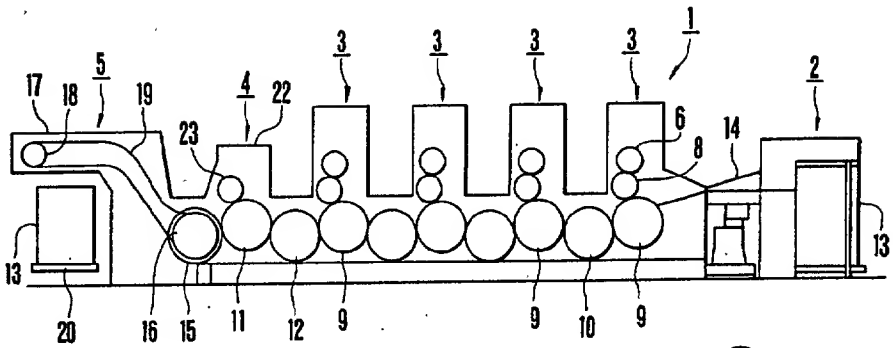

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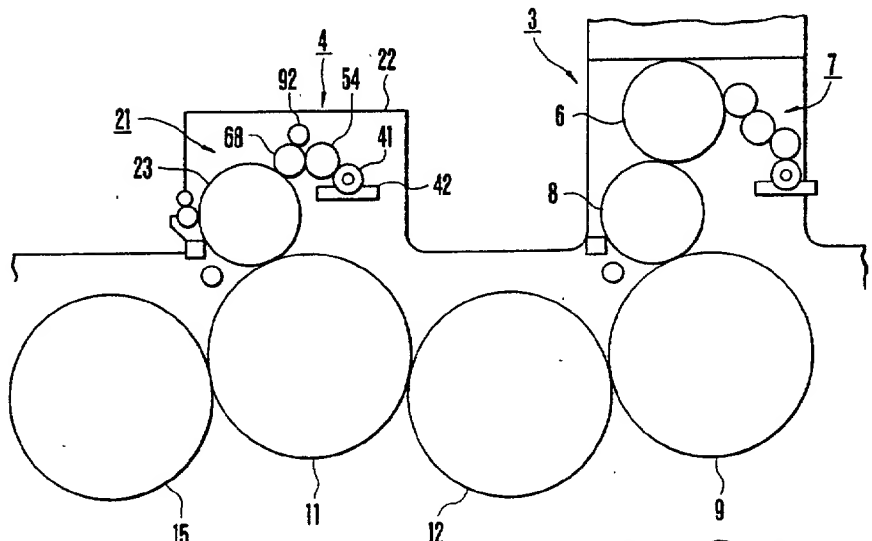
FIG.1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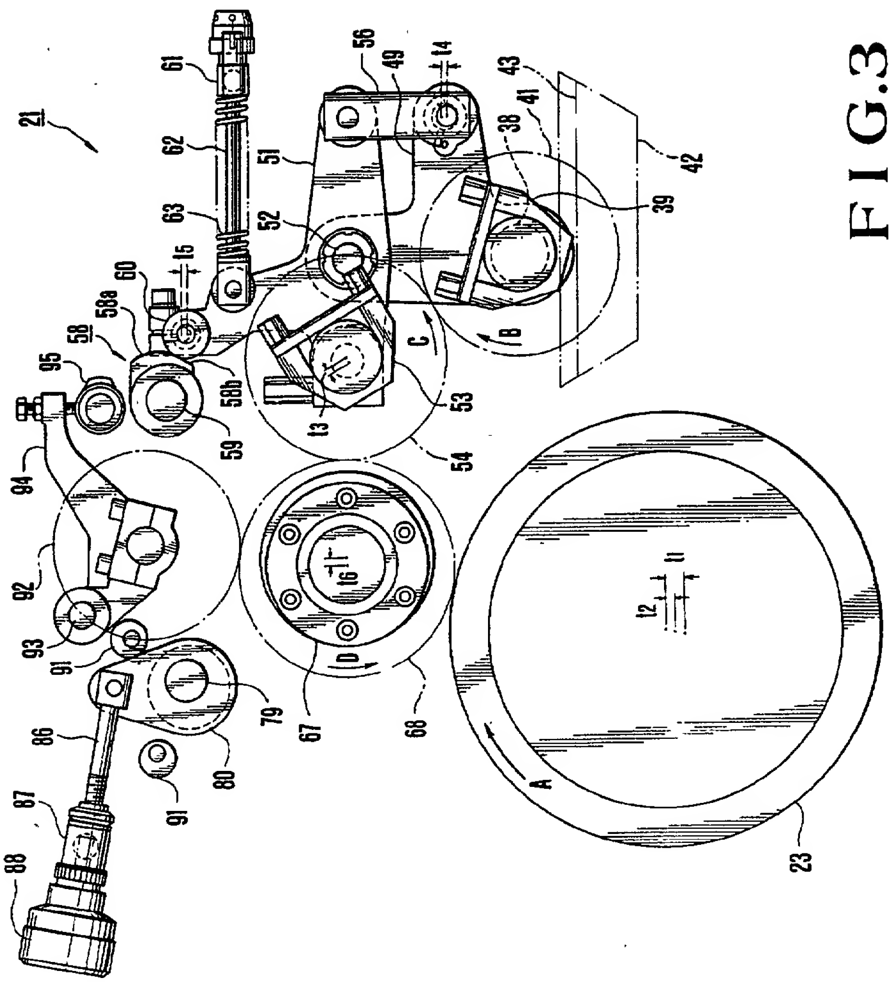
92

FIG.2


21
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56
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l4
43
41
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l5
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58a
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58b
95
59
53
C
B
54
l3
94
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93
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88
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67
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D
l6
l1
l2
A
23

FIG.3

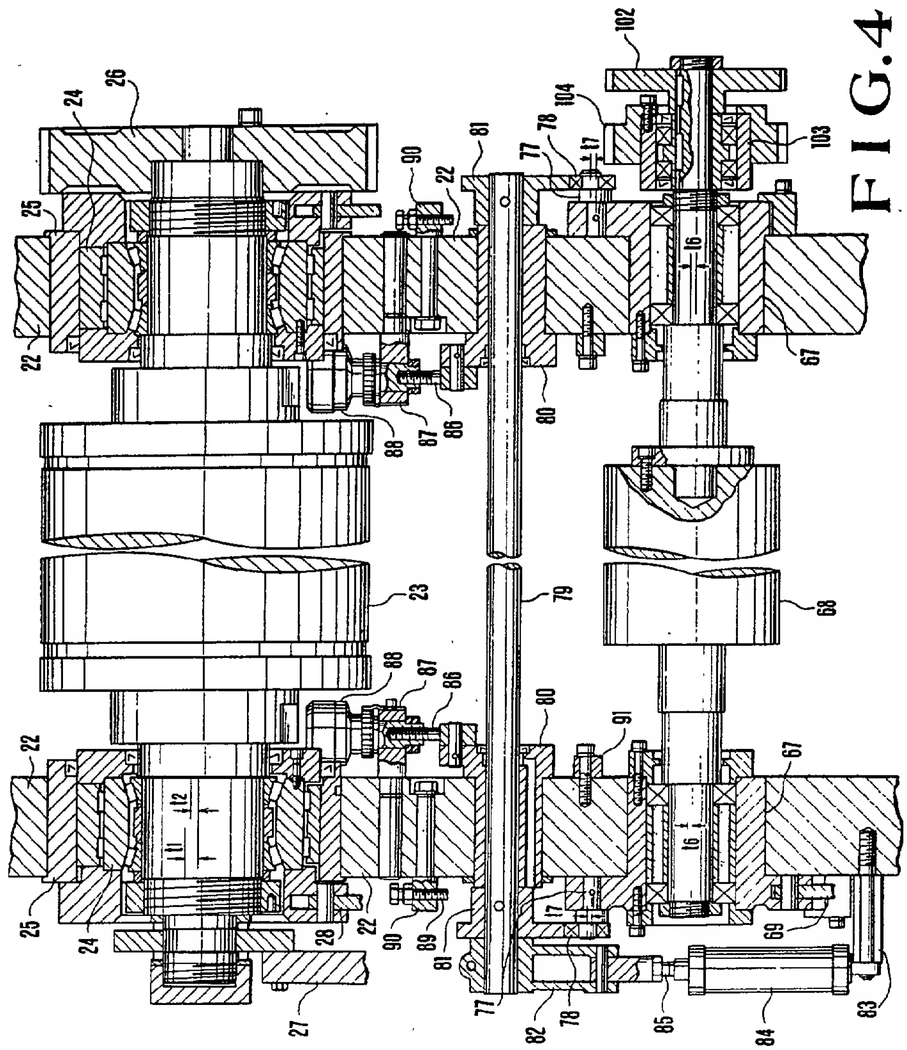

FIG.4

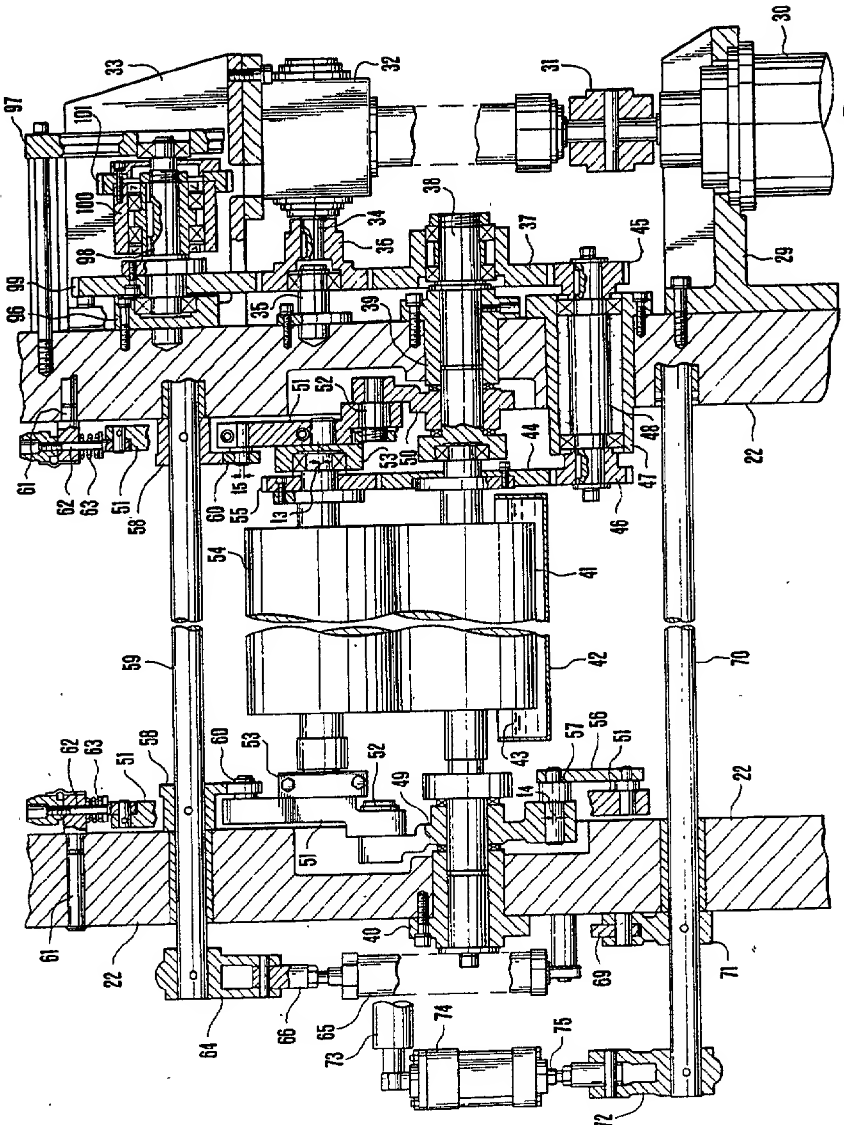
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FIG.5

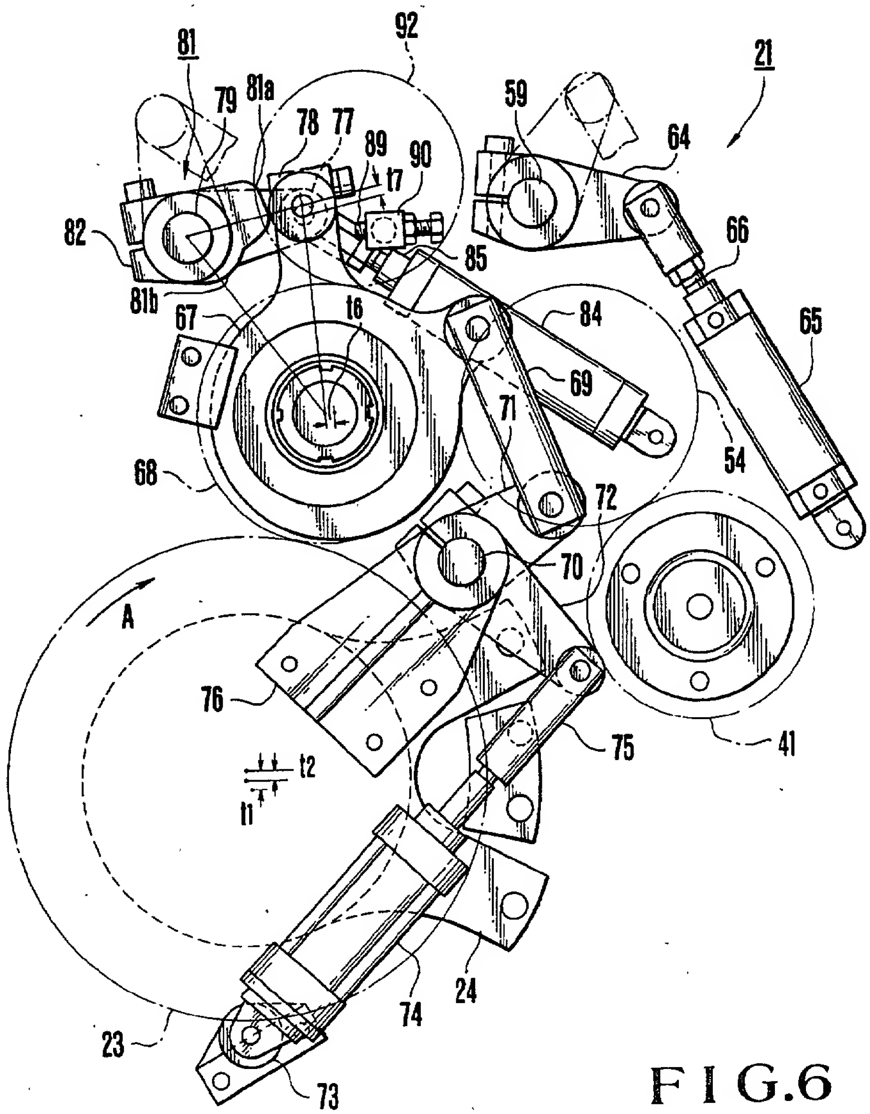
81
79
81a
92
78
77
89
90
t7
59
64
21
82
81b
85
66
67
t6
84
65
69
71
54
68
72
70
A
76
75
41
t2
t1
24
74
23
73

FIG.6

VARNISH COATER FOR PRINTED PRODUCT

BACKGROUND OF THE INVENTION

The present invention relates to a varnish coater disposed between a printing unit and a delivery apparatus of a rotary press or in an independent coating unit to apply varnish on a printed surface.

The surface of paper printed by a rotary printing press is not quickly dried and can be contaminated in the subsequent processing. In a sheet-fed rotary printing press, offsetting tends to be caused when printed sheets are stacked. In order to solve these problems, conventionally, a dryer is arranged in a delivery path of the printed products, or a powder is sprayed on the printed paper surfaces. However, in this case, the dryer becomes large, and powder spraying results in surface roughening of the printed surface. Surface roughening tends to entail a loss of gloss and subsequent poor printing. Instead of these techniques, varnish is applied to the printed surface to prevent the surface from being contaminated and to give it gloss. Varnishing is performed in printed products such as covers of books, catalogs and pamphlets which require an aesthetic effect.

The varnish coater is used as an independent apparatus. However, recently, the varnish coater is generally disposed in a delivery path of a printing press to shorten a coating time and an associated operation time for restacking the printed sheets and hence to improve the coating efficiency. The varnish coater generally has rollers in the same manner as that of a dampening apparatus for dampening a surface of a plate mounted on a plate cylinder of the printing unit. Varnish stored in a varnish pan is supplied to a surface of a blanket cylinder through the rollers. The varnish is transferred to a sheet passing between the blanket cylinder and an impression cylinder.

However, the conventional varnish coater of this thick paper such as a cover. The blanket on the surface of the blanket cylinder is partially deformed to result in a nonuniform thickness of the varnish film. In this case, a thickness of an underlay inserted between the blanket and the metal surface of the blanket cylinder must be adjusted after the rotary printing press is stopped. When the rollers are stopped for a long period of time while the coating operation is interrupted, varnish is hardened and many wasted paper sheets are produced when the coating operation is restarted. In order to prevent this, the rollers inserted between the form roller and the varnish type has the following problem in contact pressure adjustment between the blanket cylinder and the form roller for transferring varnish to the blanket cylinder. During the coating operation, since the blanket cylinder is in sliding contact with the form roller which transfers varnish to the blanket cylinder, the contact pressure of the form roller with respect to the blanket cylinder must be properly adjusted to obtain a uniform thickness of the varnish film to be coated on the printed sheet. On the other hand, the coating operation is often performed for pan must be brought into sliding contact with the form roller. After the blanket cylinder is washed or cleaned, the underlay is adjusted. Subsequently, after the underlay is adjusted, the blanket cylinder is located in the throw-on position. In this case, in order to properly perform the coating operation, the form roller must be brought into tight contact with the blanket cylinder to transfer varnish from the form roller to the blanket cylinder before the blanket cylinder is located in the throw-on position. The adjusting condition is preferably checked. For this purpose, the contact pressure of the form roller with respect to the blanket cylinder must be properly adjusted even if the blanket cylinder is located in the throw-off position.

In this manner, the contact pressure of the form roller with respect to the blanket cylinder must be controlled for both the throw-on and throw-off positions of the blanket cylinder. Conventionally, the contact pressure is adjusted by a turnbuckle and an eccentric pin, or by stoppers for defining the pivotal range of the form roller support arm. In addition, the contact pressure adjustments are independently performed at the throw-on and throw-off times of the blanket cylinder. The contact pressure adjustment must be performed every time irregular thickness is eliminated or the blanket of the blanket cylinder is worn out, resulting in time-consuming operation. In addition to this disadvantage, since an impact occurs when the form roller is brought into tight contact with the blanket cylinder by means of the form roller arm, the durability of the component parts is degraded upon repetition of the above contact operation. Furthermore, when the contact pressure is adjusted at the throw-on and -off positions, the pressure adjusted at one of the positions influences that at the other, resulting in inconvenience.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a varnish coater capable of simplifying adjustment of a contact pressure of a form roller with respect to a blanket cylinder at the throw-on and -off positions of the blanket cylinder.

It is another object of the present invention to provide a varnish coater capable of smoothly contacting the form roller with the blanket cylinder and improving the durability of the coater.

In order to achieve the above and other objects, the blanket cylinder and the form roller are respectively supported by eccentric bearings to throw on/off the blanket cylinder with respect to the form roller and an impression cylinder and throw on/off the form roller with respect to the blanket cylinder, and rollers provided in the eccentric bearings of the form roller are brought by biasing means into tight contact with cam surfaces of cams pivoted by pivot means.

According to the present invention, there is provided a varnish coater for coating varnish transferred from a form roller to a blanket cylinder on a printed sheet passing through the blanket cylinder and an impression cylinder, comprising:

first eccentric bearings for supporting the form roller;

rolling members mounted on outer end portions of the first eccentric bearings, respectively;

cams which are pivotally supported by second eccentric bearings, respectively, and each of which has a large diameter portion and a small diameter portion which are selectively brought into contact with a corresponding one of the rolling members;

first pivoting means for pivoting the cams;

biasing means for biasing the rolling members each of which is brought into tight contact with one of the large and small diameter portions of a corresponding one of the cams; and

second pivoting means for pivoting the second eccentric bearings to shift an axis of a cam shaft of the cams.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic side view of a four-color sheet-fed offset rotary printing press;

FIG. 2 is a schematic side view of a fourth color printing unit and a coating unit of the rotary printing press shown in FIG. 1;

FIG. 3 is a side view of a varnish coater of the coating unit shown in FIG. 2 according to an embodiment of the present invention;

FIG. 4 is a developed sectional view of a portion including a blanket cylinder and a form roller of the varnish coater shown in FIG. 3;

FIG. 5 is a developed sectional view of a portion including a pan roller and a metering roller of the varnish coater shown in FIG. 3; and

FIG. 6 is a side view of a throw-on and -off mechanism for rollers in correspondence with the portion shown in FIG. 3 when viewed from the outside of the frame.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGS. 1 and 2, a four-color sheet-fed offset rotary printing press 1 comprises a sheet feeder 2, four color printing units 3, a coating unit 4 and a delivery apparatus 5. These components are separately assembled and constitute the rotary printing press 1. Each printing unit 3 has a plate cylinder 6 having a printing plate thereon, an inking apparatus (not shown) for supplying a corresponding ink to the cylinder surface, and a dampening apparatus 7 for supplying dampening water to dampen the cylinder surface. A blanket cylinder 8 is brought into contact with each plate cylinder 6 on which an image is formed by utilizing the corresponding color ink and water. The image on the plate cylinder 6 is transferred to the blanket cylinder 8 upon relative rotation therebetween. In each printing unit 3, an impression cylinder 9 having a diameter twice that of the blanket cylinder 8 is brought into contact therewith. A transfer cylinder 10 having the same diameter as the impression cylinder 9 is sandwiched between adjacent impression cylinders 9 of the corresponding printing units 3. An impression cylinder 11 having a diameter twice that of a blanket cylinder 23 (having the same construction as the blanket cylinder 8) of the coating unit 4 is disposed to be in contact with the blanket cylinder 23 and at the same level as the other impression cylinders 9 of the printing units 3. A transfer cylinder 12 is sandwiched between the impression cylinder 9 of the fourth color printing unit 3 and the impression cylinder 11 of the coating unit 4. Paper sheets 13 stacked on the feed table of the sheet feeder 2 are taken up by a sheet pick-up device (not shown) and are fed one by one onto a feedboard 14. Each sheet 13 is gripped with grippers of the first color impression cylinder 9 by means of a swing gripper. The sheet 13 is printed by the blanket cylinders 8 with four colors while the sheet 13 is sequentially fed by the transfer cylinders 10 and the corresponding impression cylinders 9. The printed sheet is then gripped by grippers of the impression cylinder 11 and is wound therearound.

The delivery apparatus 5 comprises a delivery cylinder 15 which is brought into contact with the impression cylinder 11, and a pair of right and left sprockets 16 which are coaxially mounted on the delivery cylinder 15. Delivery chains 19 each having grippers at equal intervals are respectively looped between the right and left sprockets 16 and front end sprockets 18 of a delivery frame 17. The sheet 13 gripped by the grippers of the impression cylinder 11 is gripped by the grippers of the chains 19 and transferred thereby. The sheet 13 is released from the grippers of the chains onto a stack board 20.

The coating unit 4 having the construction described above has a varnish coater 21 to be described below.

Referring mainly to FIG. 4, the blanket cylinder 23 having the same diameter as that of the blanket cylinder 8 is rotatably supported by right and left frames 22, respectively, through pairs of antifriction bearings 24 and plain bearings 25. The blanket cylinder 23 is rotated in the direction indicated by arrow A (FIG. 3) upon rotation of a cylinder gear 26 coupled to a driving source. The axes of the bearings 24 and 25 are respectively deviated by distances t1 and t2 with respect to the axis of the blanket cylinder 23. A lever 27 pivotally mounted on the corresponding rolling bearing 24 of the frame 22 is reciprocated by means of an air cylinder to bring the blanket cylinder 23 into contact with or separate it from the impression cylinder 11. A lever 28 pivotally mounted on the plain bearing 25 is reciprocated by a handle to adjust the contact pressure between the blanket cylinder 23 and the impression cylinder 11.

Referring mainly to FIG. 5, a DC variable motor 30 is supported and mounted on a bracket 29 fixed on the outer surface of one of the frames 22. A gear box 32 coupled to the shaft of the motor 30 through a coupling 31 is supported and mounted on a bracket 33 fixed on the outer surface of this frame 22. A driving gear shaft 34 is coupled to the motor shaft through a bevel gear which is disposed in the gear box 32 to be perpendicular to the motor shaft. A driving gear 36 supported by a stud 35 which extends outward from the frame 22 is fixed on the driving gear shaft 34. A gear shaft 38 is supported on the frame 22 through a bearing 39 to rotatably support an intermediate gear 37 meshing with the driving gear 36. One end of a pan roller 41 is rotatably supported by the bearing portion of the gear shaft 38 extending inwardly of the frame 22. The other end of the pan roller 41 is supported by a bearing 40 of the opposing frame 22. The pan roller 41 is dipped in varnish 43 stored in a varnish pan 42. A pan roller gear 44 is fixed on a collar in the vicinity of the gear shaft 38. Reference numerals 45 and 46 denote gears which respectively mesh with the intermediate gear 37 and the pan roller gear 44 to transmit a rotational force of the intermediate gear 37 to the pan roller 41. The gears 45 and 46 are mounted on a gear shaft 48 supported by a bearing 47 which is mounted on the frame 22. The pan roller 41 rotates in a direction indicated by arrow B (FIG. 3). L-shaped roller arms 49 and 50 (the shape of the roller arm 49 is illustrated in FIG. 3 in detail) are movably mounted between the collar of the pan roller 41 and the bearing 40 and between the collar of the gear shaft 38 and the bearing 39 through thrust bearings, respectively. Inverted T-shaped arms 51 (the shape thereof is illustrated in FIG. 3 in detail) are pivotally mounted through pins 52 on corresponding free ends of the L-shaped roller arms 49 and 50, respectively. A bearing 53 is pivotally mounted on the free end of each of the T-shaped arms 51 such that the axis of the bearing 53 is deviated by a distance t3 (FIGS. 3 and 5) with respect to the shaft of a metering roller 54 having an elastic surface. Therefore, the roller 54 is supported by the bearings 53 and is brought in contact with the pan roller 41. A gear 55 mounted on the end portion of the

shaft of the roller 54 is meshed with the pan roller gear 44, so that the roller 54 is rotated in the direction indicated by arrow C (FIG. 3). Bolts are loosened to pivot the bearings 53 so as to adjust a nip pressure acting on the pan roller 41.

One of the roller arms 49 is coupled to the corresponding T-shaped arm 51 through a lever 56 having an eccentric portion indicated by a distance t4 (FIGS. 3 and 5). A pin 57 of the eccentric portion is manually pivoted to throw on/off the metering roller 54 with respect to the pan roller 41. Reference numeral 58 denotes cams each having a large diameter portion 58*a* (FIG. 3) and a small diameter portion 58*b* (FIG. 3). The cams 58 are mounted on end portions of a cam shaft 59 mounted across the right and left frames 22. These end portions are adjacent to the inner surface portions of the right and left frames 22, respectively. Rollers 60 eccentrically (indicated by a distance t5) mounted on the free ends of the T-shaped arms 51 are in contact with the cam surfaces of the cams 58, respectively. Pivotal spring shafts 62 are mounted on studs 61 extending inward from the frames 22. One end of each of pivotal spring shafts 62 is pivotally mounted on the corresponding T-shaped arm 51. The T-shaped arms 51 urge the rollers 60 which tend to abut against the cams 58 by means of compression coil springs 63 mounted on the spring shafts 62, respectively. A piston rod 66 of an air cylinder 65 having an end mounted on the corresponding frame is pivotally coupled to the free end portion of a lever 64 fixed on the end of the cam shaft 59. When the piston rod 66 is moved to pivot the cams 58, the metering roller 54 can be brought into contact with or separated from the pan roller 41 through the rollers 60 and the T-shaped arms 51.

Referring again to FIGS. 3 and 4, eccentric bearings 67 (indicated by a distance t6 in FIG. 3) are respectively mounted on the frames 22 above the blanket cylinder 23. A form roller 68 is supported by the eccentric bearings 67 and is brought into contact with the blanket cylinder 23. As shown in FIG. 4, one end of a connecting lever 69 is coupled to an outwardly extended portion of one of the eccentric bearings 67, and the other end thereof is coupled to a lever 71 which is mounted on a lever shaft 70 mounted on the frame 22. An actuator end of a piston rod 75 of an air cylinder 74 pivotally coupled to the stud 73 extending outwardly from the frame 22 is coupled to a lever 72 fixed on the other end of the lever shaft 70. When the piston rod 75 of the air cylinder 74 is moved to pivot the eccentric bearings 67 through the coupling lever 69 and the like, the form roller 68 can be thrown on/off with respect to the blanket cylinder 23. Referring to FIG. 6, reference numeral 76 denotes a bearing fixed on the bracket at the side of the frame 22 to support the lever shaft 70 outside the frame 22. As shown in FIG. 4, the roller shafts 77 are split-clamped to be pivoted. Inner rings of rollers 78 each comprising a ball bearing are respectively fixed at the eccentric portions deviated by distances t7 with respect to the axis of the roller shaft 77. Reference numeral 79 denotes a cam shaft supported by the right and left frames 22 respectively through eccentric bearings 80. As shown in FIG. 6, the position of the cam shaft 79 is preset such that the axes of the cam shaft 79, the roller 78 and the form roller 68 correspond to apexes of a right angled triangle. Cams 81 each having a large diameter portion 81*a* and a small diameter portion 81*b* are split-clamped on the cam shaft 79. In other words, the cams 81 are respectively pivotal about the eccentric bearings 80 through the cam shaft 79. A lever 82 is split-clamped on the projecting end of the cam shaft 79, and the actuator end of a piston rod 85 of an air cylinder 84 pivotally supported by the frame 22 through a stud 83 is pivotally coupled to the free end portion of the lever 82. Bolts 86 respectively extend from the extended portions of the eccentric bearings 80 which extend inside the frames 22. The bolts 86 respectively engage with nuts such that these bolts 86 are inserted in handles 88 supported by studs 87 so as not to move axially. When the handles 88 are turned to move the bolts 86 so as to turn the eccentric bearings 80, respectively, the cams 81 are eccentrically moved together with the cam shaft 79 to shift its axis. In this throw-on and -off mechanism of the form roller 68, when the piston rod 75 (FIG. 5) of the air cylinder 74 is shortened (i.e., when the eccentric bearings 67 are pivoted clockwise in FIG. 6), the form roller 68 is separated from the blanket cylinder 23. In this case, the eccentric direction of the bearings 67 is preset such that the form roller 68 is separated from the blanket cylinder 23 while the distance between the form roller 68 and the metering roller 54 is kept to be substantially constant. In the state shown in FIG. 6, the blanket cylinder 23 is in contact with the form roller 68. In this case, the piston rod of the air cylinder 84 is shortened, and the large diameter portion 81*a* of each cam 81 is in contact with the corresponding roller 78. The roller 78 is biased by an air pressure of the air cylinder 74 to abut against the corresponding cam 81. Furthermore, when the blanket cylinder 23 is removed and the form roller 68 is thrown on the blanket cylinder 23, the piston rod 85 of the air cylinder 84 is elongated to pivot the cams 81 counterclockwise. As a result, the rollers 78 are respectively brought into contact with the small diameter portions 81*b* of the cams 81 by means of the biasing force of the air cylinder 74. Therefore, the form roller 68 is held in a state wherein it contacts the blanket cylinder 23. In other words, in the throw-on and -off positions of the blanket cylinder 23, the contact forces of the form roller 68 with respect to the blanket cylinder 23 are limited by the large diameter portions 81*a* and the small diameter portions 81*b* of the cams 81. Adjustment of these contact forces is effected by the movement of the cam 81 caused by the turning of the handle 88. Referring to FIG. 4, reference numeral 89 denote off-position stoppers which are screwed in studs 90 on the frames 22, respectively. When the blanket cylinder 23 is located in the throw-on position, the piston rod 75 of the air cylinder 74 is shortened, and the eccentric bearings 67 are respectively pivoted until they abut against the stoppers 89. Therefore, the throw-off position of the form roller 68 can be defined with respect to the throw-on position of the blanket cylinder 23. Referring to FIG. 4, reference numeral 91 denotes stoppers for defining the eccentric pivotal movement of the cams 81 when the lever 82 respectively abuts against the stoppers 91. As shown in FIG. 3, a rider roller 92 is supported at each end thereof by an arm 94 pivotal about a pin 93 on the side of the frame 22 and is brought in tight contact with the form roller 68. The arm 94 swings upon pivotal movement of a cam 95 by means of a handle (not shown), so that the rider roller 92 can be thrown on/off with respect to the form roller 68.

A drive mechanism of the motor 30, the cylinder gear 26 and the form roller 68 will be described.

One end of a clutch shaft 98 is supported by a bearing 96 fixed on the frame 22 in the vicinity of the motor 30, and the other end thereof is supported by a bracket 97

extending from the frame 22. A gear 99 is fixed on the clutch shaft 98 and is meshed with the driving gear 36 to transmit rotation of the motor 30 to the clutch shaft 98. A clutch gear 101 fixed on a one-way clutch 100 (to be described in detail later) on the clutch shaft 98 is meshed with a form roller gear 102 fixed in the end portion of the roller shaft of the form roller 68. The one-way clutch 100 has a known structure capable of transmitting a rotational force in only one direction. In this embodiment, the form roller 68 is a driven member, so that the rotational force of the motor 30 is transmitted only to the form roller 68. A one-way clutch 103 having the same construction as the one-way clutch 100 is arranged in an end portion of a roller shaft of the form roller 68. A clutch gear 104 coupled to the one-way clutch 103 is meshed with the cylinder gear 26 of the blanket cylinder 23. In this case, the form roller 68 is the driven member for the one-way clutch 103, so that the rotational force of the blanket cylinder 23 is transmitted only to the form roller 68. In this manner, the form roller 68 is selectively driven by the motor 30 and the blanket cylinder 23 through the one-way clutches 100 and 103; the form roller 68 does not simultaneously receive the rotational forces through the one-way clutches 100 and 103. Either of the one-way clutches 100 and 103 which transmits a higher rotational speed is coupled to the form roller 68, and the other one of the one-way clutches 100 and 103 which transmits a lower rotational speed is decoupled from the form roller 68.

The operation of the varnish coater 21 having the arrangement described above will now be described. The motor 30 of the varnish coater 21 is started to perform the coating operation while the blanket cylinder is located at the throw-off position. The cams 58 are pivoted by the air cylinder 65 to abut the rollers 60 against the small diameter portions 58*b* of the cams 58, respectively, so that the metering roller 54 is brought into tight contact with the pan roller 41 and the form roller 68 by means of the biasing forces of the compression coil springs 63. In this case, the piston rod 75 of the air cylinder 74 is elongated so that the rollers 78 of the eccentric bearings 67 are respectively brought into tight contact with the large diameter portions 81*a* of the cams 81. The form roller 68 is located in the throw-on position. However, since the blanket cylinder 23 is located in the throw-off position, the form roller 68 is separated from the blanket cylinder 23. In this case, the rotation of the motor 30 is transmitted to the pan roller 41 and the metering roller 54 through the bevel gear in the gear box 32, and the gears 36, 37, 45, 46, 44 and 55. The rotation of the motor 30 is also transmitted to the form roller 68 through the gears 36 and 99, the one-way clutch 100 and the gears 101 and 102. The blanket cylinder 23 is separated from the impression cylinder 11, and these cylinders are stopped. Upon rotation of the above-mentioned rollers, the varnish 43 is drawn by the pan roller 41 from the varnish pan 42. A thickness of the varnish film is adjusted upon contact between the pan roller 41 and the metering roller 54. The varnish film having a predetermined thickness is transferred to the form roller 68. Varnish circulates through the pan roller 41, the metering roller 54 and the form roller 68. When the rotary printing press is started to feed a sheet 13 onto the feedboard 14 by means of the automatic feeder 2, the blanket cylinders 8 of the printing units 3 are located in the throw-on positions, so that the sheet 13 is subjected to four-color process printing through the blanket cylinders and the corresponding impression cylinders 9. The printed sheet is fed toward the coating unit 4. When the printed sheet reaches the coating unit 4, the plain bearings 25 are pivoted in response to the command from a timing controller, so that the blanket cylinder 23 is located in the throw-on position, and that the blanket cylinder 23 is brought into tight contact with the impression cylinder 11 and the form roller 68. Varnish circulating between the form roller 68 and the pan roller 41 is transferred to the blanket cylinder 23 and is applied to the printed sheet passing between the blanket cylinder 23 and the impression cylinder 11. The coated sheet 13 is fed by the delivery chains 19 and is stacked on the stack board 20. In the throw-on position of the blanket cylinder 23, the rotational force is transmitted from the motor 30 to the form roller 68 through the one-way clutch 100. At the same time, since the blanket cylinder 23 is located in the throw-on position, the rotational force of the blanket cylinder 23 is transmitted to the form roller 68 through the gears 26 and 104 and the one-way clutch 103. The rotational speed of the blanket cylinder 23 is higher than that of the motor 30, so that only the rotational force of the blanket cylinder 23 is transmitted to the form roller 68. The one-way clutch 100 is decoupled from the form roller 68.

The throw-on/off operation of the form roller 68 and the adjustment of the contact pressure of the form roller 68 with respect to the blanket cylinder 23 during the coating operation will be described.

During the coating operation as previously described, the blanket cylinder 23 is located in the throw-on position with respect to the impression cylinder 11 and the form roller 68. In other words, the blanket cylinder 23 is brought into tight contact with the impression cylinder 11 and the form roller 68. In this case, the rollers 78 are respectively in contact with the large diameter portions 81*a* of the cams 81. The piston rod 75 of the air cylinder 74 is biased in a direction toward which the piston rod 75 is elongated by the air pressure. The rollers 78 are in tight contact with the large diameter portions 81*a* of the cams 81, so that the pivotal movement of the eccentric bearings 67 are defined by the tight contact between the rollers 78 and the corresponding large diameter portions 81*a*. As previously described, when the blanket of the blanket cylinder 23 is partially deformed and the thickness of the varnish film becomes nonuniform, the rotary printing press is stopped to eliminate irregular thickness of the underlay. In this case, the blanket cylinders 8 of the printing units 3 are located in the throw-off positions. At the same time, the blanket cylinder 23 of the varnish coater 21 is also located in the throw-off position with respect to the impression cylinder 11 and the form roller 68. Even if the blanket cylinder 23 is located in the throw-off position, the gear 26 continues to mesh with the the gear 104. The form roller 68 continues to be driven by the blanket cylinder 23 through the one-way clutch 103. At the same time, the pan roller 41 and the metering roller 54 continues to be driven by the motor 30, so that the varnish circulates between the varnish pan 42 and the form roller 68 and will not be hardened. The rollers 78 are held in contact with the large diameter portions 81*a* of the cams 81, respectively, so that the form roller 68 is separated from the blanket cylinder 23. After the blanket cylinder 23 is cleaned, the underlay of the blanket is adjusted to eliminate the nonuniform thickness of the underlay. After the adjustment is completed, the air cylinder 84 is actuated to elongate the piston rod 85. When the cams 81 are pivoted counterclockwise (FIG.

6) through about 90°, the rollers 78 are pivoted until they are respectively brought into tight contact with the small diameter portions 81*b* of the cams 81 since the eccentric bearings 67 are biased by the air cylinder 74. Therefore, the form roller 68 is brought into contact with the blanket cylinder 23 which is located in the throw-off position, so that the varnish in circulation is transferred from the form roller 68 to the blanket cylinder 23. In this condition, the operator can visually observe and check varnish coating from the form roller 68 to the blanket cylinder 23, thereby checking the result of underlay adjustment. When the printing operation is then restarted, the air cylinders 74 and 84 are actuated in response to predetermined time signals from the timing controller. The rollers 78 are brought into tight contact with the large diameter portions 81*a* of the cams 81 and the blanket cylinder 23 is located in the throw-on position. Therefore, the form roller 68 is brought into tight contact with the blanket cylinder 23 at a contact pressure preset by the cams 81 and the rollers 78.

In the coating operation performed in the manner as described above, when the blanket cylinder 23 is located in the throw-on position, the rollers 78 are respectively brought into tight contact with the large diameter portions 81*a* of the cams 81 by the air pressure of the air cylinder 74. The contact pressure of the form roller 68 with respect to the blanket cylinder 23 is defined by the tight contact between the rollers 78 and the corresponding large diameter portions 81*a*. On the other hand, when the blanket cylinder 23 is located in the throw-off position, the rollers 78 are respectively brought into tight contact with the small diameter portions 81*b* by the air pressure of the air cylinder 74. In this manner the contact pressure of the form roller 68 with respect to the blanket cylinder 23 is defined by the tight contact between the rollers 78 and the small diameter portions 81*b*. The contact pressure can be adjusted by rotating the eccentric bearings 80 mounted on the cam shaft 79 by means of handles 88. In other words, the contact pressure can be adjusted by a change in distance between the axes of the cam 81 and the corresponding roller 78. In this case, even if the position of the cam 81 is changed, the position of the large diameter portion 81*a* is not changed relative to that of the small diameter portion 81*b*. Only by changing the position of the cams 81, the contact pressures at the times when the blanket cylinder 23 is located in the throw-on and -off positions can be simultaneously adjusted. When split-clamping is released to pivot the roller shafts 77 of the rollers 78, the rollers 78 can be moved away from or closer to the axis of the roller 68. As is apparent from FIG. 6, the eccentric bearings 67 are slightly rotated, so that the difference (i.e., cam lift) between each small diameter portion 81*b* and the corresponding large diameter portion 81*b* can change. Therefore, the contact pressure at the time of throw-on operation of the blanket cylinder 23 relative to that at the time of throw-off operation thereof can be adjusted. In this case, if at least one of the large diameter portion 81*a* and the small diameter portion 81*b* comprises a concentric arc but has a slope along the circumferential direction, the cam lift can be easily changed. The zero contact pressure point adjustment can be easily performed. An error in the manufacturing process can be properly absorbed, and an adjustment at the time of wear can be easily performed.

In the above embodiment, the rollers 78 are respectively brought into tight contact with the surfaces of the cams 81 by the air cylinder 74 as the biasing means. If the form roller 68 need not be located in the throw-off position with respect to the blanket cylinder 23 when the blanket cylinder 23 is located in the throw-off position, the biasing means may comprise a coil spring in place of the air cylinder.

As is apparent from the above description, in the varnish coater for the printed product according to the present invention, the blanket cylinder and the form roller are respectively supported by eccentric bearings to throw on/off the blanket cylinder with respect to the form roller and an impression cylinder and throw on/-off the form roller with respect to the blanket cylinder, and the rollers provided in the eccentric bearings of the form roller are respectively brought by biasing means into tight contact with cam surfaces of cams pivoted by pivot means so as to change with an identical magnitude contact pressures of the form roller with respect to the blanket cylinder at the throw-on and -off positions of the blanket cylinder. By changing the position of the axis of the cam, the contact pressures of the form roller with respect to the throw-on and -off positions of the blanket cylinder can be simultaneously adjusted. Therefore operability can be greatly improved as compared with the conventional mechanism wherein the contact pressures are adjusted by the turnbuckle and the like, thereby improving the operation efficiency and decreasing labor. In addition to these advantage, since the form roller is brought into tight contact with or is separated from the blanket cylinder upon pivotal movement of the eccentric bearings, the impact caused by the contact between the form roller and the blanket cylinder is decreased, and durability of the members can be improved. In addition, the contact pressure adjustment at the time of throw-on position of the blanket cylinder will not influence that at the time of throw-off position thereof. Furthermore, the rollers can be adjusted to be away from and closer to the form roller. When the slope is formed on the cam surface along the circumferential direction of the cam, the cam lift can be changed. The error in the manufacturing process can be absorbed, and the cam lift adjustment at the time of wear of the cam surface can be easily performed.

What is claimed is:

1. A varnish coater for coating varnish transferred from a form roller to a blanket cylinder on a printed sheet passing through the blanket cylinder and an impression cylinder, comprising:

first eccentric bearings for supporting said form roller;

rolling members mounted on outer end portions of said first eccentric bearings, respectively;

cams which are pivotally supported by second eccentric bearings, respectively, and each of which has a large diameter portion and a small diameter portion which are selectively brought into contact with a corresponding one of said rolling members;

first pivoting means for pivoting said cams;

biasing means for biasing said rolling members each of which is brought into tight contact with one of said large and small diameter portions of a corresponding one of said cams; and

second pivoting means for pivoting said second eccentric bearings to shift an axis of a cam shaft of said cams.

2. A varnish coater according to claim 1, wherein said first pivoting means comprises:

an air cylinder which is operated in response to a given timing signal;

a piston rod which is reciprocally inserted in said air cylinder; and

a lever coupled between said piston rod and one of said cams to pivot said cams.

3. A varnish coater according to claim 1, wherein said biasing means comprises:

an air cylinder which is operated in response to a given timing signal;

a piston rod which is reciprocally inserted in said air cylinder;

a first lever one end of which is connected to said piston rod;

a second lever one end of which is connected to the other end of said first lever; and

a connecting lever one end of which is connected to the other end of said second lever and the other end of which is coupled to an extended portion of one of said first eccentric bearings.

4. A varnish coater according to claim 1, wherein said second pivoting means comprises:

bolts mounted on extended portions of said second eccentric bearings, respectively;

handles coupled to said bolts through studs, respectively; and

stoppers for defining a range of pivotal movement of each of said second eccentric bearings.

5. A varnish coater according to claim 1, wherein said cam shaft has an axis which constitutes a right-angled triangle together with axes of said rolling members and said form roller.

* * * * *

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United States Patent [19]

Ito et al.

[11] **Patent Number: 4,569,306**

[45] **Date of Patent: Feb. 11, 1986**

[54] **VARNISH COATER FOR PRINTED PRODUCT**

[75] Inventors: **Kiyoshi Ito**, Chiba; **Tamotsu Omori**, Ibaragi, both of Japan

[73] Assignee: **Komori Printing Machinery Co., Ltd.**, Tokyo, Japan

[21] Appl. No.: **576,220**

[22] Filed: **Feb. 2, 1984**

[30] **Foreign Application Priority Data**

Feb. 3, 1983 [JP] Japan 58-16600

[51] **Int. Cl.**[4] **B05C 1/02**

[52] **U.S. Cl.** **118/249**; 118/46; 118/236; 118/262

[58] **Field of Search** .... 118/46, 249, 203, 262, 118/236; 101/350, 351, 352, 416 B

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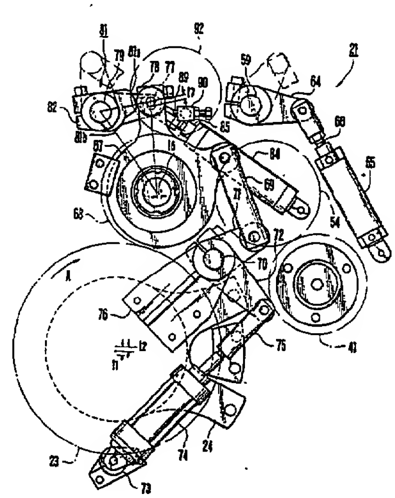
Primary Examiner—John P. McIntosh

Attorney, Agent, or Firm—Blakely Sokoloff Taylor & Zafman

[57] **ABSTRACT**

In a varnish coater, a set of a blanket cylinder and a form roller and a set of a pan roller and a metering roller are driven by different drive sources. One-way clutches are arranged between the blanket cylinder and the form roller and between the form roller and a motor as one of the different drive sources, respectively. The form roller is selectively driven by one of the different drive sources through a corresponding one-way clutch. Alternatively, the form roller is driven by one of the drive sources which has a higher rotational speed.

5 Claims, 8 Drawing Figures



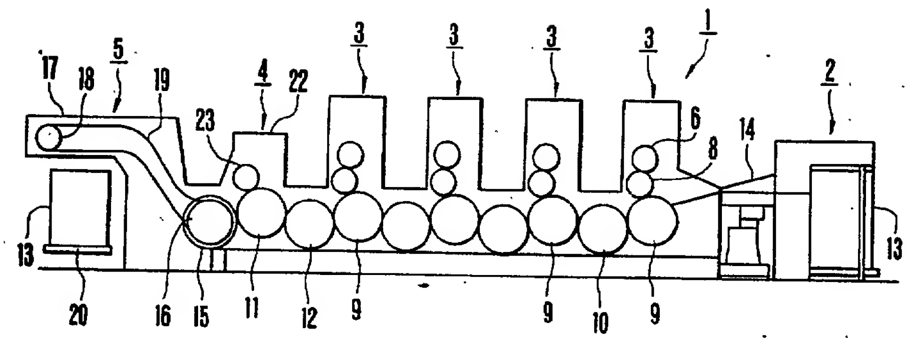

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FIG.1

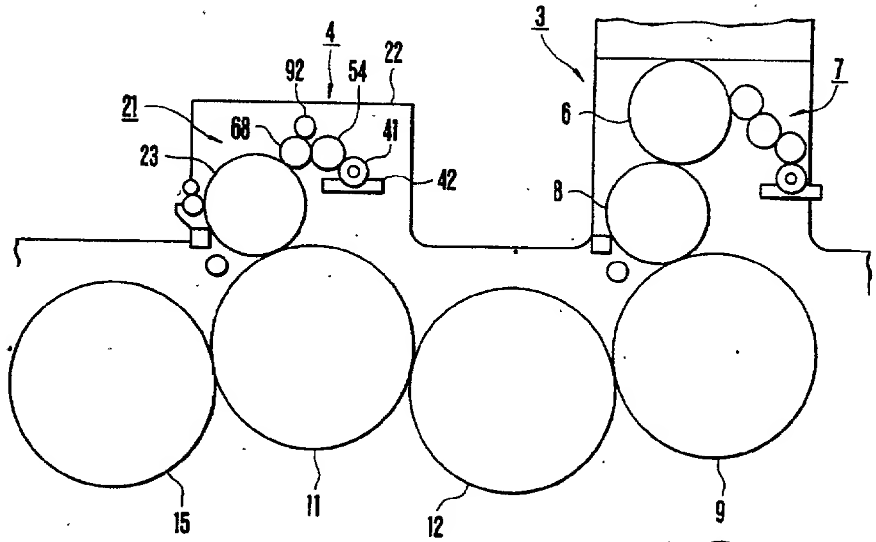
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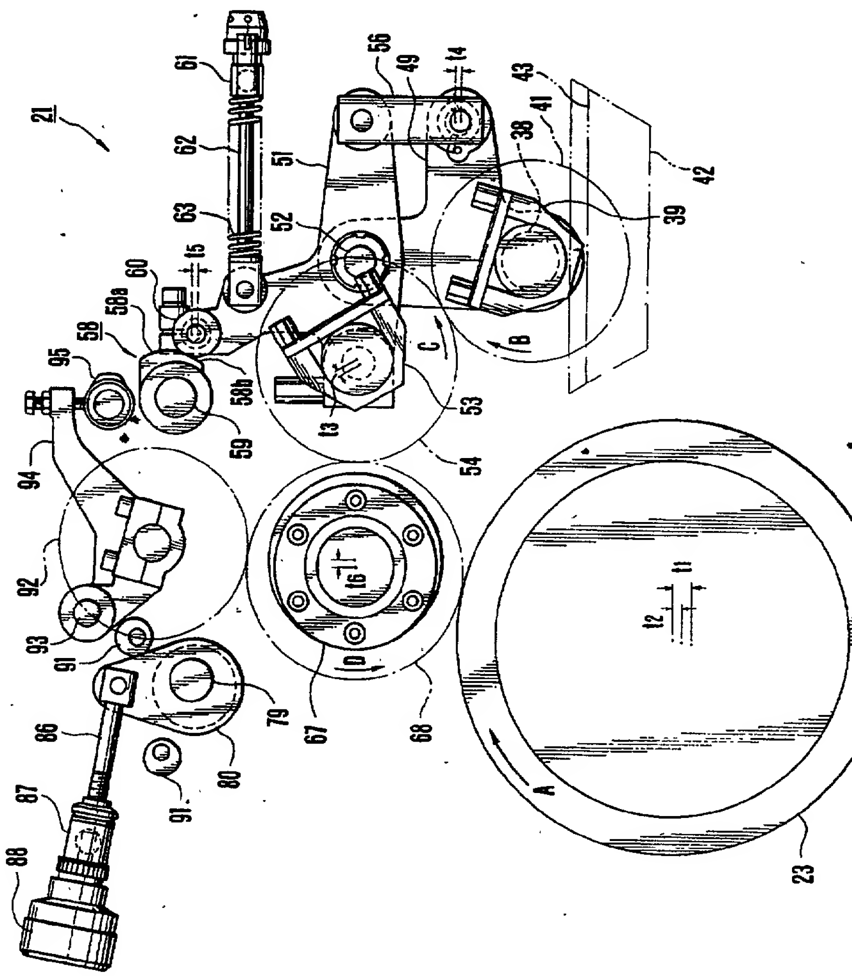
FIG.2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13
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C
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FIG.3

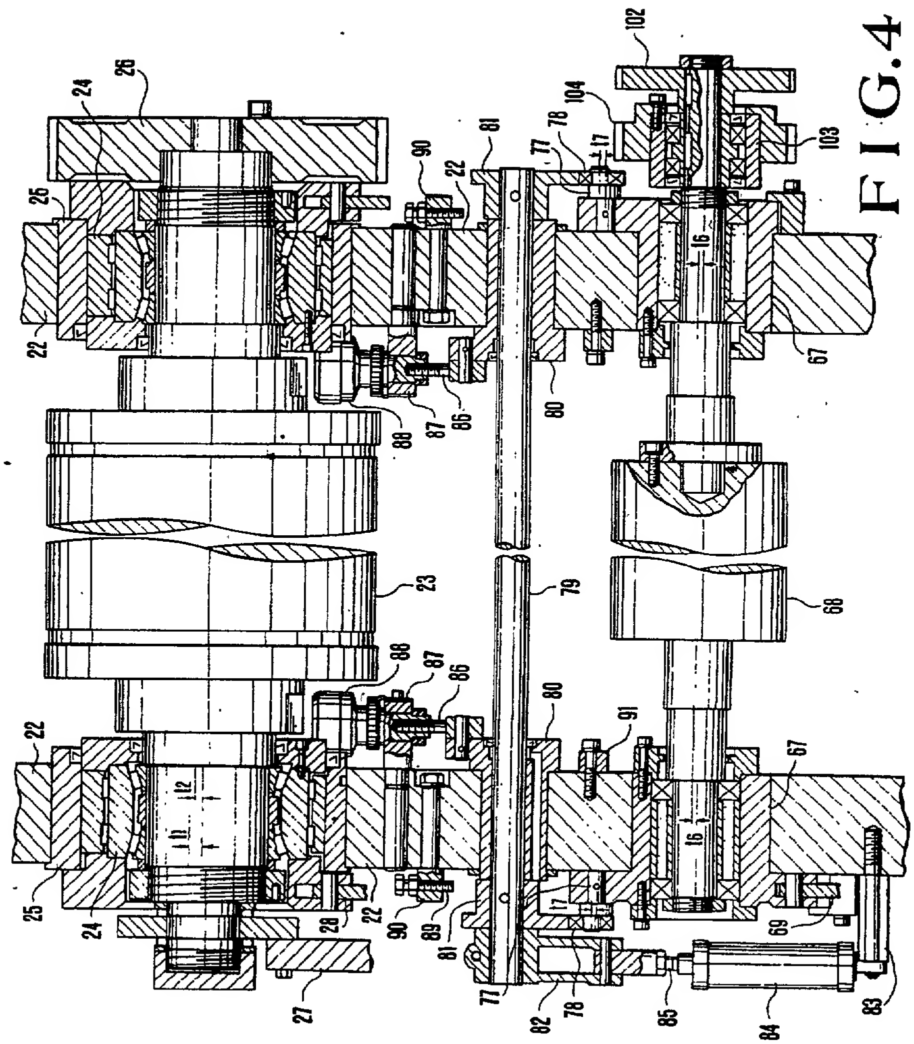


FIG. 4

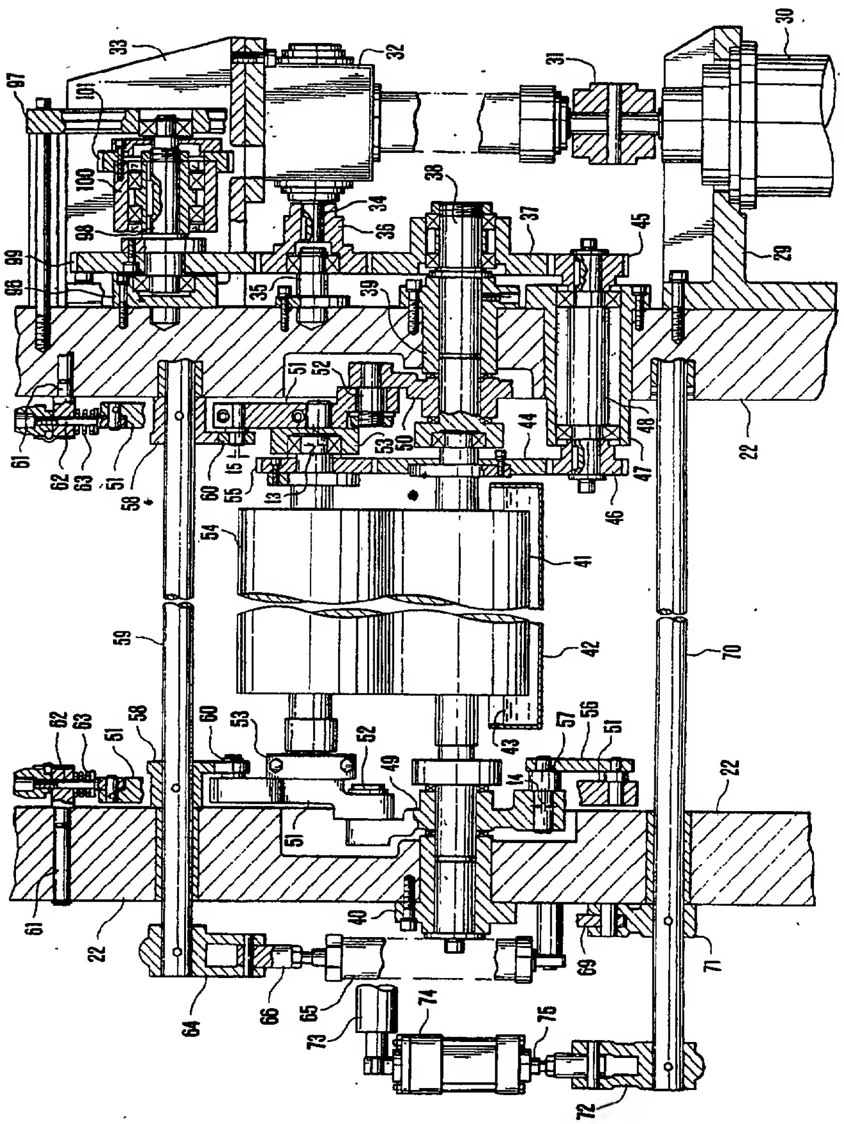
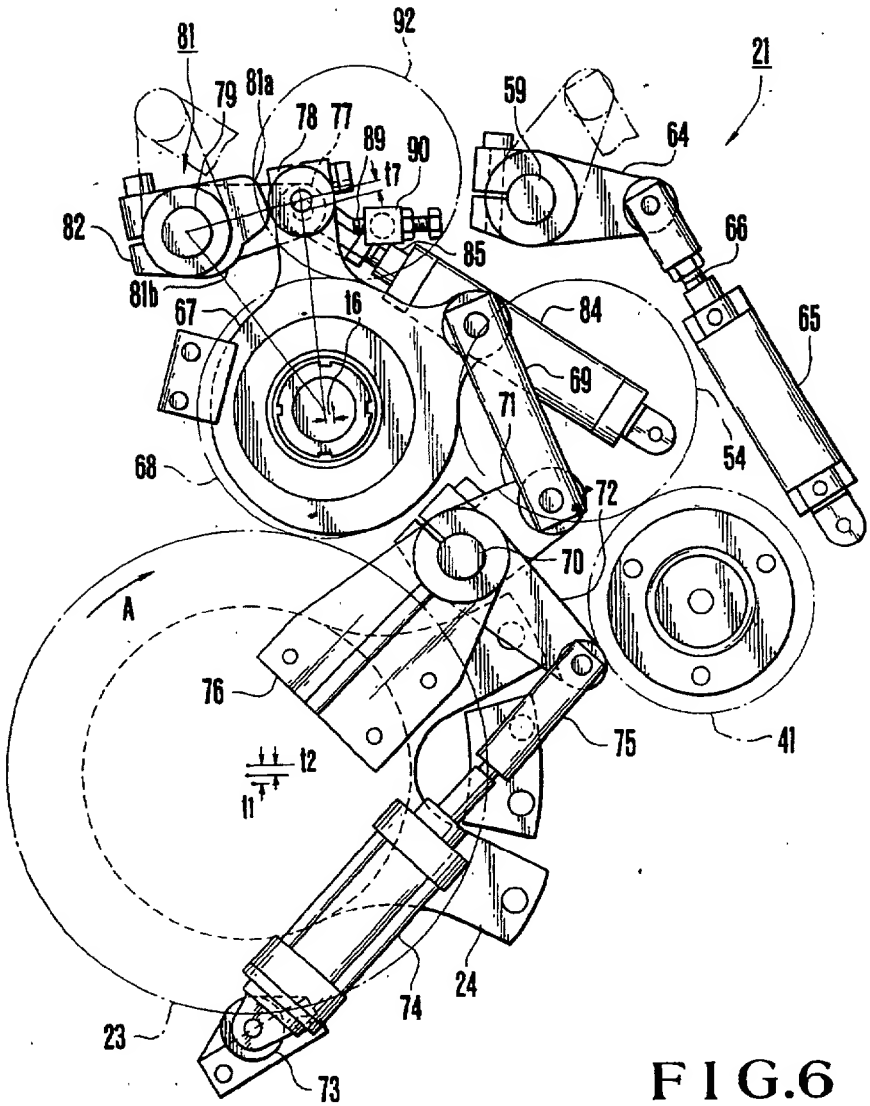


FIG.5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A
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76
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t2
t1
24
74
23
73

FIG.6

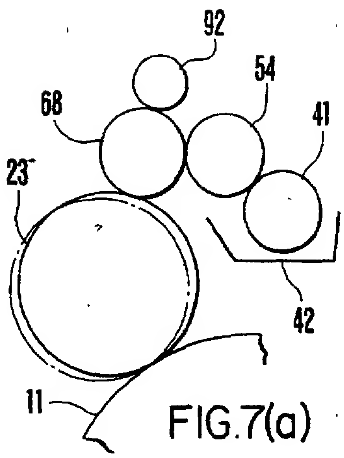

FIG.7(a)

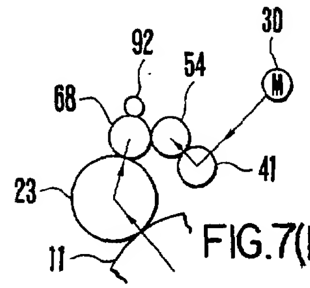

FIG.7(b)

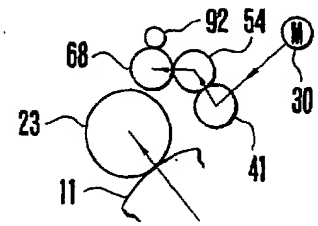

FIG.7(c)

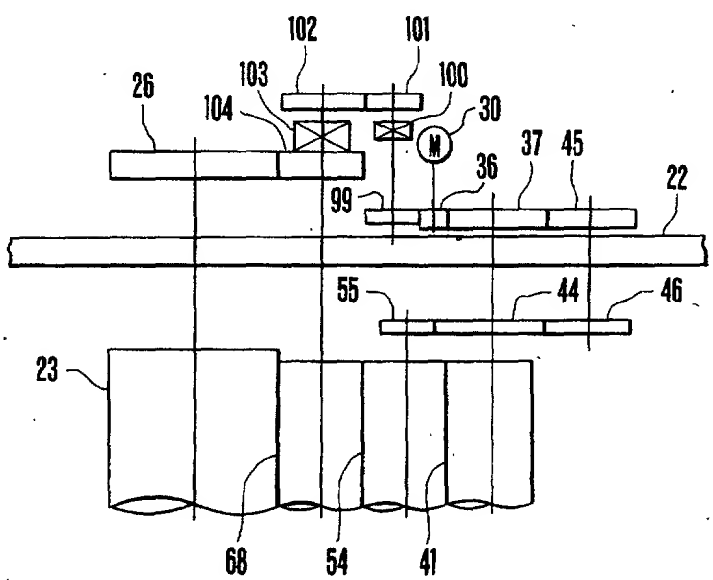

FIG.8

VARNISH COATER FOR PRINTED PRODUCT

BACKGROUND OF THE INVENTION

The present invention relates to a varnish coater disposed between a printing unit and a delivery apparatus of a rotary press or in an independent coating unit to apply varnish on a printed surface.

The surface of paper printed by a rotary printing press is not quickly dried and can be contaminated in the subsequent processing. In a sheet-fed rotary printing press, offsetting tends to be caused when printed sheets are stacked. In order to solve these problems, conventionally, a dryer is arranged in a delivery path of the printed products, or a powder is sprayed on the printed paper surfaces. However, in this case, the dryer becomes large, and powder spraying results in surface roughening of the printed surface. Surface roughening tends to entail a loss of gloss and subsequent poor printing. Instead of these techniques, varnish is applied to the printed surface to prevent the surface from being contaminated and to give it gloss. Varnishing is performed in printed products such as covers of books, catalogs and pamphlets which require an aesthetic effect.

The varnish coater is used as an independent apparatus. However, recently, the varnish coater is generally disposed in a delivery path of a printing press to shorten a coating time and an associated operation time for restacking the printed sheets and hence to improve the coating efficiency. The varnish coater generally has rollers in the same manner as that of a dampening apparatus for dampening a surface of a plate mounted on a plate cylinder of the printing unit. Varnish stored in a varnish pan is supplied to a surface of a blanket cylinder through the rollers. The varnish is transferred to a sheet passing between the blanket cylinder and an impression cylinder.

However, in the conventional varnish coater of this type, there arise problems in respect to a rotation transmission mechanism of each roller and a nonuniform thickness of a varnish film caused thereby. The printing press is stopped when the sheets are restacked, or a stack board is replaced, or an underlay for a blanket of the blanket cylinder is adjusted due to a change in paper size. In such a case, the blanket cylinder is separated from the impression cylinder, while the rollers used for applying varnish continue to rotate to prevent varnish from hardening before the restart time.

It is occasionally required that the blanket cylinder be driven from the drive line side of the press, and that the rollers consisting of a pan roller (upsteam roller), a metering roller and a form roller be driven by another variable motor so as to adjust the thickness of a varnish film. When the above operation is performed, however irregular rotation occurs between the blanket cylinder and the form roller which are driven by the different drive sources, thus resulting in an irregular thickness of the varnish film. However, when the form roller is coupled to the blanket cylinder through a gear, the form roller must be stopped when the blanket cylinder is stopped for cleaning and adjustment of the underlay of the blanket. As a result, the varnish on the outer surface of the form roller is hardened, and the form roller must also be cleaned, resulting in inconvenience.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a varnish coater capable of preventing irregular rotation between a blanket cylinder and a form roller to obtain a uniform thickness of a varnish film and hence to improve quality of printed products.

It is another object of the present invention to provide a varnish coater capable of preventing varnish on the form roller from being hardened while the blanket cylinder is stopped.

It is still another object of the present invention to provide a varnish coater capable of simultaneously cleaning the blanket cylinder and the form roller.

It is still another object of the present invention to provide a varnish coater capable of minimizing wasted paper by separating the blanket cylinder from the form roller to check varnishing, thereby improving the coating efficiency.

It is still another object of the present invention to provide a low-cost varnish coater which eliminates a need for electrical control, thereby simplifying maintenance procedures and preventing erroneous operation.

In order to achieve the above and other objects of the present invention, there is provided a varnish coater for a printed product, comprising:

upstream rollers for picking up and metering varnish;

a form roller which is brought into contact with one of the upstream rollers to receive the varnish therefrom;

a blanket cylinder which is selectively brought into contact with the form roller and an impression cylinder;

a main drive source for driving the impression cylinder and selectively driving the form roller;

a subdrive source for driving the upstream rollers and selectively driving the form roller;

first and second one-way clutches arranged between the blanket cylinder and the form roller and between the form roller and the subdrive source, respectively; and

a gear mechanism for selectively transmitting a rotational force to the form roller.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic side view of a four-color sheet-fed offset rotary printing press;

FIG. 2 is a schematic side view of a fourth color printing unit and a coating unit of the rotary printing press shown in FIG. 1;

FIG. 3 is a side view of a varnish coater of the coating unit shown in FIG. 2 according to an embodiment of the present invention;

FIG. 4 is a developed sectional view of a portion including a blanket cylinder and a form roller of the varnish coater shown in FIG. 3;

FIG. 5 is a developed sectional view of a portion including a pan roller and a metering roller of the varnish coater shown in FIG. 3;

FIG. 6 is a side view of a throw-on and -off mechanism for rollers in correspondence with the portion shown in FIG. 3 when viewed from the outside of the frame;

FIGS. 7*a*–7*c* are a representation for explaining roller driving; and

FIG. 8 is a schematic representation of a roller drive unit.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGS. 1 and 2, a four-color sheet-fed offset rotary printing press 1 comprises a sheet feeder 2, four color printing units 3, a coating unit 4 and a deliv-

ery apparatus 5. These components are separately assembled and constitute the rotary printing press 1. Each printing unit 3 has a plate cylinder 6 having a printing plate thereon, an inking apparatus (not shown) for supplying a corresponding ink to the cylinder surface, and a dampening apparatus 7 for supplying dampening water to dampen the cylinder surface. A blanket cylinder 8 is brought into contact with each plate cylinder 6 on which an image is formed by utilizing the corresponding color ink and water. The image on the plate cylinder 6 is transferred to the blanket cylinder 8 upon relative rotation therebetween. In each printing unit 3, an impression cylinder 9 having a diameter twice that of the blanket cylinder 8 is brought into contact therewith. A transfer cylinder 10 having the same diameter as the impression cylinder 9 is sandwiched between adjacent impression cylinders 9 of the corresponding printing units 3. An impression cylinder 11 having a diameter twice that of a blanket cylinder 23 (having the same construction as the blanket cylinder 8) of the coating unit 4 is disposed to be in contact with the blanket cylinder 23 and at the same level as the other impression cylinders 9 of the printing units 3. A transfer cylinder 12 is sandwiched between the impression cylinder 9 of the fourth color printing unit 3 and the impression cylinder 11 of the coating unit 4. Paper sheets 13 stacked on the feed table of the sheet feeder 2 are taken up by a sheet pick-up device (not shown) and are fed one by one onto a feedboard 14. Each sheet 13 is gripped with grippers of the first color impression cylinder 9 by means of a swing gripper. The sheet 13 is printed by the blanket cylinders 8 with four colors while the sheet 13 is sequentially fed by the transfer cylinders 10 and the corresponding impression cylinders 9. The printed sheet is then gripped by grippers of the impression cylinder 11 and is wound therearound.

The delivery apparatus 5 comprises a delivery cylinder 15 which is brought into contact with the impression cylinder 11, and a pair of right and left sprockets 16 which are coaxially mounted on the delivery cylinder 15. Delivery chains 19 each having grippers at equal intervals are respectively looped between the right and left sprockets 16 and front end sprockets 18 of a delivery frame 17. The sheet 13 gripped by the grippers of the impression cylinder 11 is gripped by the grippers of the chains 19 and transferred thereby. The sheet 13 is released from the grippers of the chains onto a stack board 20.

The coating unit 4 having the construction described above has a varnish coater 21 to be described below.

Referring mainly to FIG. 4, the blanket cylinder 23 having the same diameter as that of the blanket cylinder 8 is rotatably supported by right and left frames 22, respectively, through pairs of antifriction bearings 24 and plain bearings 25. The blanket cylinder 23 is rotated in the direction indicated by arrow A (FIG. 3) upon rotation of a cylinder gear 26 coupled to a driving source. The axes of the bearings 24 and 25 are respectively deviated by distances t1 and t2 with respect to the axis of the blanket cylinder 23. A lever 27 pivotally mounted on the corresponding rolling bearing 24 of the frame 22 is reciprocated by means of an air cylinder to bring the blanket cylinder 23 into contact with or separate it from the impression cylinder 11. A lever 28 pivotally mounted on the plain bearing 25 is reciprocated by a handle to adjust the contact pressure between the blanket cylinder 23 and the impression cylinder 11.

Referring mainly to FIG. 5, a DC variable motor 30 is supported and mounted on a bracket 29 fixed on the outer surface of one of the frames 22. A gear box 32 coupled to the shaft of the motor 30 through a coupling 31 is supported and mounted on a bracket 33 fixed on the outer surface of this frame 22. A driving gear shaft 34 is coupled to the motor shaft through a bevel gear which is disposed in the gear box 32 to be perpendicular to the motor shaft. A driving gear 36 supported by a stud 35 which extends outward from the frame 22 is fixed on the driving gear shaft 34. A gear shaft 38 is supported on the frame 22 through a bearing 39 to rotatably support an intermediate gear 37 meshing with the driving gear 36. One end of a pan roller 41 is rotatably supported by the bearing portion of the gear shaft 38 extending inwardly of the frame 22. The other end of the pan roller 41 is supported by a bearing 40 of the opposing frame 22. The pan roller 41 is dipped in varnish 43 stored in a varnish pan 42. A pan roller gear 44 is fixed on a collar in the vicinity of the gear shaft 38. Reference numerals 45 and 46 denote gears which respectively mesh with the intermediate gear 37 and the pan roller gear 44 to transmit a rotational force of the intermediate gear 37 to the pan roller 41. The gears 45 and 46 are mounted on a gear shaft 48 supported by a bearing 47 which is mounted on the frame 22. The pan roller 41 rotates in a direction indicated by arrow B (FIG. 3). L-shaped roller arms 49 and 50 (the shape of the roller arm 49 is illustrated in FIG. 3 in detail) are movably mounted between the collar of the pan roller 41 and the bearing 40 and between the collar of the gear shaft 38 and the bearing 39 through thrust bearings, respectively. Inverted T-shaped arms 51 (the shape thereof is illustrated in FIG. 3 in detail) are pivotally mounted through pins 52 on corresponding free ends of the L-shaped roller arms 49 and 50, respectively. A bearing 53 is pivotally mounted on the free end of each of the T-shaped arms 51 such that the axis of the bearing 53 is deviated by a distance t3 (FIGS. 3 and 5) with respect to the shaft of a metering roller 54 having an elastic surface. Therefore, the roller 54 is supported by the bearings 53 and is brought in contact with the pan roller 41. A gear 55 mounted on the end portion of the shaft of the roller 54 is meshed with the pan roller gear 44, so that the roller 54 is rotated in the direction indicated by arrow C (FIG. 3). Bolts are loosened to pivot the bearings 53 so as to adjust a nip pressure acting on the pan roller 41.

One of the roller arms 49 is coupled to the corresponding T-shaped arm 51 through a lever 56 having an eccentric portion indicated by a distance t4 (FIGS. 3 and 5). A pin 57 of the eccentric portion is manually pivoted to throw on/off the metering roller 54 with respect to the pan roller 41. Reference numeral 58 denotes cams each having a large diameter portion 58*a* (FIG. 3) and a small diameter portion 58*b* (FIG. 3). The cams 58 are mounted on end portions of a cam shaft 59 mounted across the right and left frames 22. These end portions are adjacent to the inner surface portions of the right and left frames 22, respectively. Rollers 60 eccentrically (indicated by a distance t5) mounted on the free ends of the T-shaped arms 51 are in contact with the cam surfaces of the cams 58, respectively. Pivotal spring shafts 62 are mounted on studs 61 extending inward from the frames 22. One end of each of pivotal spring shafts 62 is pivotally mounted on the corresponding T-shaped arm 51. The T-shaped arms 51 urge the rollers 60 which tend to abut against the cams 58 by

means of compression coil springs 63 mounted on the spring shafts 62, respectively. A piston rod 66 of an air cylinder 65 having an end mounted on the corresponding frame is pivotally coupled to the free end portion of a lever 64 fixed on the end of the cam shaft 59. When the piston rod 66 is moved to pivot the cams 58, the metering roller 54 can be brought into contact with or separated from the pan roller 41 through the rollers 60 and the T-shaped arms 51.

Referring again to FIGS. 3 and 4, eccentric bearings 67 (indicated by a distance t6 in FIG. 3) are respectively mounted on the frames 22 above the blanket cylinder 23. A form roller 68 is supported by the eccentric bearings 67 and is brought into contact with the blanket cylinder 23. As shown in FIG. 4, one end of a connecting lever 69 is coupled to an outwardly extended portion of one of the eccentric bearings 67, and the other end thereof is coupled to a lever 71 which is mounted on a lever shaft 70 mounted on the frame 22. An actuator end of a piston rod 75 of an air cylinder 74 pivotally coupled to the stud 73 extending outwardly from the frame 22 is coupled to a lever 72 fixed on one end of the lever shaft 70. When the piston rod 75 of the air cylinder 74 is moved to pivot the eccentric bearings 67 through the coupling lever 69 and the like, the form roller 68 can be thrown on/off with respect to the blanket cylinder 23. Referring to FIG. 6, reference numeral 76 denotes a bearing fixed on the bracket at the side of the frame 22 to support the lever shaft 70 outside the frame 22. As shown in FIG. 4, the roller shafts 77 are split-clamped to be pivoted. Inner rings of rollers 78 each comprising a ball bearing are respectively fixed at the eccentric portions deviated by distances t7 with respect to the axis of the roller shaft 77. Reference numeral 79 denotes a cam shaft supported by the right and left frames 22 respectively through eccentric bearings 80. As shown in FIG. 6, the position of the cam shaft 79 is preset such that the axes of the cam shaft 79, the roller 78 and the form roller 68 correspond to apexes of a right angled triangle. Cams 81 each having a large diameter portion 81*a* and a small diameter portion 81*b* are split-clamped on the cam shaft 79. In other words, the cams 81 are respectively pivotal about the eccentric bearings 80 through the cam shaft 79. A lever 82 is split-clamped on the projecting end of the cam shaft 79, and the actuator end of a piston rod 85 of an air cylinder 84 pivotally supported by the frame 22 through a stud 83 is pivotally coupled to the free end portion of the lever 82. Bolts 86 respectively extend from the extended portions of the eccentric bearings 80 which extend inside the frames 22. The bolts 86 respectively engage with nuts such that these bolts 86 are inserted in handles 88 supported by studs 87 so as not to move axially. When the handles 88 are turned to move the bolts 86 so as to turn the eccentric bearings 80, respectively, the cams 81 are eccentrically moved together with the cam shaft 79 to shift its axis. In this throw-on and -off mechanism of the form roller 68, when the piston rod 75 (FIG. 5) of the air cylinder 74 is shortened (i.e., when the eccentric bearings 67 are pivoted clockwise in FIG. 6), the form roller 68 is separated from the blanket cylinder 23. In this case, the eccentric direction of the bearings 67 is preset such that the form roller 68 is separated from the blanket cylinder 23 while the distance between the form roller 68 and the metering roller 54 is kept to be substantially constant. In the state shown in FIG. 6, the blanket cylinder 23 is in contact with the form roller 68. In this case, the piston rod of the air cylinder 84 is shortened, and the large diameter portion 81*a* of each cam 81 is in contact with the corresponding roller 78. The roller 78 is biased by an air pressure of the air cylinder 74 to abut against the corresponding cam 81. Furthermore, when the blanket cylinder 23 is removed and the form roller 68 is thrown on the blanket cylinder 23, the piston rod 85 of the air cylinder 84 is elongated to pivot the cams 81 counterclockwise. As a result, the rollers 78 are respectively brought into contact with the small diameter portions 81*b* of the cams 81 by means of the biasing force of the air cylinder 74. Therefore, the form roller 68 is held in a state wherein it contacts the blanket cylinder 23. In other words, in the throw-on and -off positions of the blanket cylinder 23, the contact forces of the form roller 68 with respect to the blanket cylinder 23 are limited by the large diameter portions 81*a* and the small diameter portions 81*b* of the cams 81. Adjustment of these contact forces is effected by the movement of the cam 81 caused by the turning of the handle 88. Referring to FIG. 4, reference numeral 89 denote off-position stoppers which are screwed in studs 90 on the frames 22, respectively. When the blanket cylinder 23 is located in the throw-on position, the piston rod 75 of the air cylinder 74 is shortened, and the eccentric bearings 67 are respectively pivoted until they abut against the stoppers 89. Therefore, the throw-off position of the form roller 68 can be defined with respect to the throw-on position of the blanket cylinder 23. Referring to FIG. 4, reference numeral 91 denotes stoppers for defining the eccentric pivotal movement of the cams 81 when the lever 82 respectively abuts against the stoppers 91. As shown in FIG. 3, a rider roller 92 is supported at each end thereof by an arm 94 pivotal about a pin 93 on the side of the frame 22 and is brought in tight contact with the form roller 68. The arm 94 swings upon pivotal movement of a cam 95 by means of a handle (not shown), so that the rider roller 92 can be thrown on/off with respect to the form roller 68.

The drive mechanism of the motor 30, the cylinder gear 26 and the form roller 68 will be described with reference to mainly FIGS. 7 and 8.

One end of a clutch shaft 98 is supported by a bearing 96 fixed on the frame 22 in the vicinity of the motor 30, and the other end thereof is supported by a bracket 97 extending from the frame 22. A gear 99 is fixed on the clutch shaft 98 and is meshed with the driving gear 36 to transmit rotation of the motor 30 to the clutch shaft 98. A clutch gear 101 fixed on a one-way clutch 100 (to be described in detail later) on the clutch shaft 98 is meshed with a form roller gear 102 fixed in the end portion of the roller shaft of the form roller 68. The one-way clutch 100 has a known structure capable of transmitting a rotational force in only one direction. In this embodiment, the form roller 68 is a driven member, so that the rotational force of the motor 30 is transmitted only to the form roller 68. A one-way clutch 103 having the same construction as the one-way clutch 100 is arranged in an end portion of a roller shaft of the form roller 68. A clutch gear 104 coupled to the one-way clutch 103 is meshed with the cylinder gear 26 of the blanket cylinder 23. In this case, the form roller 68 is the driven member for the one-way clutch 103, so that the rotational force of the blanket cylinder 23 is transmitted only to the form roller 68. In this manner, the form roller 68 is selectively driven by the motor 30 and the blanket cylinder 23 through the one-way clutches 100 and 103; the form roller 68 does not simultaneously receive the rotational forces through the one-way

clutches 100 and 103. Either of the one-way clutches 100 and 103 which transmits a higher rotational speed is coupled to the form roller 68, and the other one of the one-way clutches 100 and 103 which transmits a lower rotational speed is decoupled from the form roller 68.

Referring to FIG. 7(*a*), the solid line position of the blanket cylinder 23 is defined as a throw-on position with respect to the form roller 68 and the impression cylinder 11. FIG. 7(*b*) shows a rotation transmission path when the blanket cylinder 23 is located in the throw-on position. In this case, the pan roller 41 and the metering roller 54 are driven by the motor 30, and the form roller 68 is driven by the impression cylinder 11 and the blanket cylinder 23 through the one-way clutch 103. Therefore, the one-way clutch 100 is decoupled from the form roller 68. Referring again to FIG. 7(*a*), the dotted line position of the blanket cylinder 23 is defined as a throw-off position with respect to the form roller 68. FIG. 7(*c*) shows a rotation transmission path when the blanket cylinder 23 is located in the throw-off position. In this case, the form roller 68 is driven by the motor 30 through the pan roller 41 and the metering roller 54 via the one-way clutch 100. Only the blanket cylinder 23 is driven by the impression cylinder 11. Therefore, the one-way clutch 103 is decoupled from the form roller 68.

The operation of the varnish coater 21 having the arrangement described above will now be described. The motor 30 of the varnish coater 21 is started to perform the coating operation while the blanket cylinder is located at the throw-off position. The cams 58 are pivoted by the air cylinder 65 to abut the rollers 60 against the small diameter portions 58*b* of the cams 58, respectively, so that the metering roller 54 is brought into tight contact with the pan roller 41 and the form roller 68 by means of the biasing forces of the compression coil springs 63. In this case, the piston rod 75 of the air cylinder 74 is elongated so that the rollers 78 of the eccentric bearings 67 are respectively brought into tight contact with the large diameter portions 81*a* of the cams 81. The form roller 68 is located in the throw-on position. However, since the blanket cylinder 23 is located in the throw-off position, the form roller 68 is separated from the blanket cylinder 23. In this case, the rotation of the motor 30 is transmitted to the pan roller 41 and the metering roller 54 through the bevel gears in the gear box 32, and the gears 36, 37, 45, 46, 44 and 55. The rotation of the motor 30 is also transmitted to the form roller 68 through the gears 36 and 99, the one-way clutch 100 and the gears 101 and 102. The blanket cylinder 23 is separated from the impression cylinder 11, and these cylinders are stopped. Upon rotation of the above-mentioned rollers, the varnish 43 is drawn by the pan roller 41 from the varnish pan 42. A thickness of the varnish film is adjusted upon contact between the pan roller 41 and the metering roller 54. The varnish film having a predetermined thickness is transferred to the form roller 68. Varnish circulates through the pan roller 41, the metering roller 54 and the form roller 68. When the rotary printing press is started to feed a sheet 13 onto the feedboard 14 by means of the automatic feeder 2, the blanket cylinders 8 of the printing units 3 are located in the throw-on positions, so that the sheet 13 is subjected to four-color process printing through the blanket cylinders and the corresponding impression cylinders 9. The printed sheet is fed toward the coating unit 4. When the printed sheet reaches the coating unit 4, the plain bearings 25 are pivoted in response to the command from a timing controller, so that the blanket cylinder 23 is located in the throw-on position, and that the blanket cylinder 23 is brought into tight contact with the impression cylinder 11 and the form roller 68. Varnish circulating between the form roller 68 and the pan roller 41 is transferred to the blanket cylinder 23 and is applied to the printed sheet passing between the blanket cylinder 23 and the impression cylinder 11. The coated sheet 13 is fed by the delivery chains 19 and is stacked on the stack board 20. In the throw-on position of the blanket cylinder 23, the rotational force is transmitted from the motor 30 to the form roller 68 through the one-way clutch 100. At the same time, since the blanket cylinder 23 is located in the throw-on position, the rotational force of the blanket cylinder 23 is transmitted to the form roller 68 through the gears 26 and 104 and the one-way clutch 103. The rotational speed of the blanket cylinder 23 is higher than that of the motor 30, so that only the rotational force of the blanket cylinder 23 is transmitted to the form roller 68. The one-way clutch 100 is decoupled from the form roller 68.

When the coating operation is completed and the stack board 20 of the delivery apparatus 5 is replaced with an empty stack board, or the underlay of the blanket is adjusted if the blanket becomes thin, sheet feeding is stopped. In this condition, the blanket cylinders 8 of the printing units are moved in the throw-off positions, and the blanket cylinder 23 is simultaneously thrown off with respect to the impression cylinder 11 and the form roller 68. In this case, the cylinder gear 26 is slightly meshed with the gear 104, and the motor 30 continues to rotate. Therefore, the form roller 68 continues to be driven by the blanket cylinder 23 through the one-way clutch 103. At the same time, the pan roller 41 and the metering roller 54 continues to be driven by the motor 30, so that the varnish 43 circulates in a path between the varnish pan 42 and the form roller 68 and will not be hardened. In the case of adjusting the underlay of the blanket of the blanket cylinder 23, the rotary printing press is stopped, and the blanket cylinder 23 is cleaned and the underlay is adjusted. In this case, the form roller 68 is driven by the motor 30 through the one-way clutch 100. After the underlay is adjusted, the rotary printing press is started. When the air cylinder 84 is actuated to elongate the piston rod 85, the cams 81 are rotated counterclockwise (FIG. 6) through about 90°. In this case, the eccentric bearings 67 are biased by the air cylinder 74 and are rotated until the rollers 78 respectively abut against the small diameter portions 81*b* of the cams 81. Therefore, the form roller 68 is brought into contact with the blanket cylinder 23 which is located in the off position, and the varnish under circulation is transferred to the blanket cylinder 23. The cylinder gear 26 is meshed with the gear 104, so that the form roller 68 is driven by the blanket cylinder 23 through the one-way clutch 103 at a speed higher than the rotational speed of the motor 30 since the rotation of the impression cylinder is transmitted through meshing between the gears 26 and 104 even if the blanket cylinder 23 is located in the throw-off position. Thereafter, when the sheet 13 is fed and reaches the blanket cylinder 23, the air cylinders 74 and 84 are actuated in response to predetermined timing signals from the timing controller. As a result, the rollers 78 are respectively brought into tight contacts with the large diameter portions 81*a* of the cams 81, and the blanket cylinder 23 is located in the throw-on position. Therefore, the form roller 68 is brought into tight contact with the blanket

cylinder 23 by a contact pressure preset by the cams 81 and the rollers 78, thereby to restore the coating condition which existed before sheet feeding was stopped. In order to simultaneously clean the form roller 68 and the blanket cylinder 23, the form roller 68 is brought into contact with the blanket cylinder 23 which is located in the throw-off position. The form roller 68 is driven through the blanket cylinder 23. In addition, in order to manually clean the blanket cylinder 23, the blanket cylinder 23 is located in the throw-off position, and the impression cylinder 11 is stopped. The blanket cylinder 23 can be washed while the form roller 68 is located in the off state with respect to the blanket cylinder 23. Therefore, the form roller 68 is driven by the motor 30.

The present invention is not limited to the particular embodiment described above. It is essential to rotate the blanket cylinder in synchronism with the form roller. For example, the form roller 68 can be brought into tight contact with only the pan roller 41, and the metering roller 54 can be brought into tight contact with only the pan roller 41. The same effect as in the above embodiment can be obtained even in this modification. The rotational direction of the rollers is not limited to the way as described above.

As is apparent from the above embodiment, in the varnish coater for the printed product, the blanket cylinder and the form roller, and the rollers located in the upstream of the form rollers are driven by the separate drive sources. The one-way clutches are arranged between the blanket cylinder and the form roller and between the form roller and the upsteam drive source, respectively. The form roller is selectively driven by one of the blanket cylinder drive source and the upstream drive source. In addition, the form roller is driven by one of the drive sources which has a higher rotational speed. The form roller can be driven without damage irrespective of the throw-on and -off operation between blanket cylinder and the form roller. Therefore, the coating operation can be properly performed, varnish can be applied to the rollers while the blanket cylinder and the form roller are respectively located in the throw-off positions, and the varnishing operation can be checked while the blanket cylinder and the form roller are respectively located in the throw-off and throw-on positions. These operations can be performed without irregular rotation between the blanket cylinder and the form roller, thereby eliminating the nonuniform thickness of the varnish film and hence improving the quality of the printed products. In addition, while the blanket cylinder is stopped, the form roller can be continuously rotated together with the metering roller and the pan roller, thereby preventing hardening of varnish. Furthermore, varnishing can be checked while the blanket cylinder is located in the throw-off position, thereby decreasing occurrence of wasted paper and improving the coating operation. In addition to these advantages, the electrical control system is not required, so that a low-cost varnish coater can be obtained, the maintenance procedures can be simplified, and the erroneous operation can be eliminated.

What is claimed is:

1. A varnish coater for a printed product, comprising:
upstream rollers for picking up and metering varnish;
a form roller which is brought into contact with one of said upstream rollers to receive the varnish therefrom;
a blanket cylinder which is selectively brought into contact with said form roller and an impression roller;
a main drive source for driving said impression roller and selectively driving said form roller;
a subdrive source for driving said upstream rollers and selectively driving said form roller;
first and second one-way clutches arranged between said blanket cylinder and said form roller and between said form roller and said subdrive source, respectively; and
a gear mechanism for selectively transmitting a rotational force to said form roller;
wherein said subdrive source drives said form roller via a subdrive source gear, a first transfer gear meshed with the subdrive source gear, said second one-way clutch, a second transfer gear meshed with a form roller gear, and said form roller gear, when said blanket cylinder is separated from said form roller, said subdrive source gear, said first and second transfer gears and said form roller gear being included in said gear mechanism.

2. A varnish coater according to claim 1, wherein said main drive source drives said blanket cylinder through said impression cylinder, and said blanket cylinder drives said form roller through a blanket cylinder gear, a first one-way clutch gear meshed with said blanket cylinder gear and, said first one-way clutch when said blanket cylinder is held in a throw-on position, and said blanket cylinder gear, said first one-way clutch gear, being included in said gear mechanism.

3. A varnish coater according to claim 1, wherein said form roller is driven by one of said main drive source and said subdrive source which has a higher rotational speed.

4. A varnish coater according to claim 3, wherein said main drive source has a rotational speed higher than that of said subdrive source.

5. A varnish coater according to claim 1, wherein said upstream rollers comprise a metering roller and a pan roller, said pan roller being dipped in varnish.

* * * * *

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United States Patent [19]
Jahn

[11] **Patent Number: 4,615,293**
[45] **Date of Patent: Oct. 7, 1986**

[54] **MEDIUM-APPLYING DEVICE IN A PRINTING MACHINE**

[75] Inventor: **Hans-Georg Jahn**, Wiesenbach, Fed. Rep. of Germany

[73] Assignee: **Heidelberger Druckmaschinen AG**, Heidelberg, Fed. Rep. of Germany

[21] Appl. No.: **636,916**

[22] Filed: **Aug. 2, 1984**

[30] **Foreign Application Priority Data**

Aug. 3, 1983 [DE] Fed. Rep. of Germany 3327993

[51] **Int. Cl.**⁴ **B05C 1/02**; B05C 11/10

[52] **U.S. Cl.** **118/46**; 118/212; 118/221; 118/249; 118/255; 118/262

[58] **Field of Search** 118/46, 221, 222, 255, 118/262, 212, 249

[56] **References Cited**

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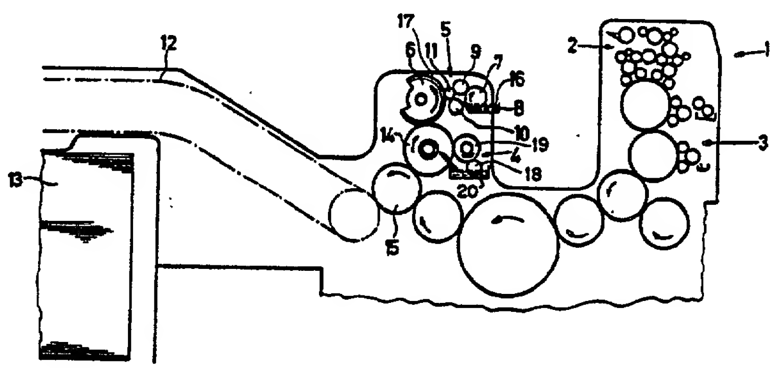
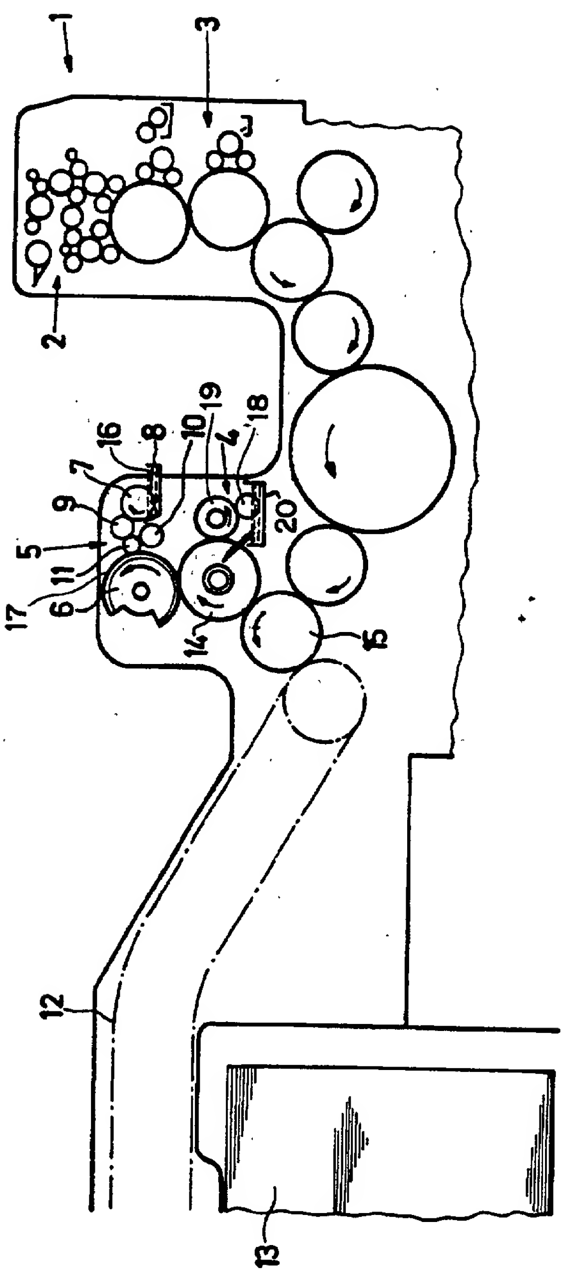
Primary Examiner—Evan K. Lawrence
Attorney, Agent, or Firm—Herbert L. Lerner; Laurence A. Greenberg

[57] **ABSTRACT**

In a printing machine, a medium applicator disposed downstream of printing units of the machine, in travel direction through the machine of a sheet being printed, the medium applicator having an assembly formed of a first roller for taking up medium from a supply container, a second roller for metering a quantity of the medium to be applied, and a third roller for transferring the medium, the third roller having a continuous cylindrical surface with a rubber lining disposed thereon for directly applying the medium onto the sheet, the three rollers being in constant meshing engagement with a sheet-transfer cylinder during application of the medium, the medium applicator further comprising a plate cylinder having a cylindrical surface interrupted by a transverse channel and carrying a flexible relief plate having raised surfaces thereon, and another assembly of rollers for supplying medium from another supply container to the raised surfaces of the flexible relief plate, the plate cylinder being in operative engagement with the third roller.

3 Claims, 1 Drawing Figure

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MEDIUM-APPLYING DEVICE IN A PRINTING MACHINE

The invention relates to a medium applicator in a printing machine and, more particularly, to such a medium applicator which is disposed downstream of printing units of a printing machine, as viewed in travel direction through the machine of a sheet being printed therein, the medium applicator having an assembly formed of a first roller for taking up medium from a supply container, a second roller for metering a quantity of the medium to be applied, and a third roller for transferring the medium, the third roller having a continuous cylindrical surface with a rubber lining disposed thereon for directly applying the medium onto the sheet, the three rollers being in constant meshing engagement with a sheet-transfer cylinder during application of the medium. A medium applicator of this general type has been described in my commonly owned co-pending application Ser. No. 626,732 filed July 2, 1984, now abandoned.

A lacquering or varnishing device in printing machines has become known heretofore from German Published Non-Prosecuted Application No. (DE-OS) 30 46 257. This device includes a lacquer storage tank or supply container and a scooping roller dipping into this tank. The lacquer taken up by the scooping roller is fed in metered fashion to an applicator roller. Two doctor rollers, by means of which a format-related lacquer feed occurs, can be set close to the scooping roller. A ductor blade applicable against the metering roller is also provided. This ductor blade serves to wipe superfluous lacquer from the metering roller and to return it to the supply container.

A specific disadvantage of this heretofore known device is that the lacquer is fed to the varnishing or lacquering cylinder via a distributor roller and an application roller. Because of the relatively long transport distance which the lacquer has to cover over many rollers until it reaches the printed sheet, the lacquer begins to set i.e. no quick-drying lacquers can be used. Due to this limitation to slowly drying lacquers, when the sheet is delivered the reverse side or back of the next following sheet will smear the lacquer and thus paste the sheets together. Consequently, no full sheet piles can be set up, because the pile weight which is built up at the delivery end and which applies a load to the individual sheets also limits the lacquer layer thickness.

In the device described in German Pat. No. 23 45 183 for applying a medium there are provided a dipping roller, a metering roller, an applicator roller, a back-pressure cylinder, a form cylinder and another applicator roller. The two applicator rollers, the dipping roller and the metering roller are combined into a common structural unit. Within this structural unit, either the dipping roller with the form cylinder or the first applicator roller with the form cylinder or the second applicator roller with the back-pressure cylinder can cooperate.

A disadvantage of this last-mentioned construction is that the lacquer must first be fed to the printed material via the form cylinder. The platen mounted on the clamping device at the form cylinder forms a channel in which the lacquer accumulates after a given operating time. This lacquer-accumulation results in an irregular lacquer application due to dripping of the lacquer down onto the printed material.

German Pat. No. 20 20 584 is based upon a device for avoiding smearing of the ink due to lacquering. By means of a lacquering unit, the lacquer is applied to a printing-unit cylinder. This printing-unit cylinder, which has the same diameter as that of the cylinders of the preceding printing units, transfers the lacquer to the printed material. The disadvantages referred to hereinbefore are also applicable to this construction and require additionally, time-consuming cleaning work to be performed on the rollers. Moreover, the construction of the printing unit is complicated by having to attach the lacquering unit to the rubber of blanket cylinder.

A further disadvantage of the state of art as exemplified by the references cited hereinbefore, is that, due to the directions of rotation of the rollers, the format-related wiping by the ductor blade cannot be observed, thus making impossible a precise wiping or removal of the superfluous lacquer material.

It is an object of the invention of the instant application to provided a further improvement over the construction in my aforementioned co-pending application in the form of a supplemental medium-applying device which is suitable especially for coating or lacquering surfaces which are interrupted or spaced from one another and, furthermore, to provide a supplementary medium applicator or lacquering unit for applying coatings or for lacquering with layers of any selected thickness.

With the foregoing and other objects in view, there is provided, in accordance with the invention, in a printing machine, a medium-applicator disposed downstream of printing units of the machine, in the travel direction through the machine of a sheet being printed, the medium applicator having an assembly formed of a first roller for taking up medium from a supply container, a second roller for metering a quantity of the medium to be applied, and a third roller for transferring the medium, the third roller having a continuous cylindrical surface with a rubber lining disposed thereon for directly applying the medium onto the sheet, the three rollers being in constant meshing engagement with a sheet-transfer cylinder during application of the medium, the medium applicator further comprising a plate cylinder having a cylindrical surface interrupted by a transverse channel and carrying a flexible relief plate having raised surfaces thereon, and another assembly of rollers for supplying medium from another supply container to the raised surfaces of the flexible relief plate, the plate cylinder being in operative engagement with the third roller.

In this lacquering device or medium application, it is possible to apply medium or lacquer by means of a flexible relief or letterpress plate which is disposed on a plate cylinder. Fields or sections of the most varied size and shape are provided on this relief plate in order to perform the desired application of medium or lacquering of areas which are interrupted or spaced from one another.

In accordance with a further feature of the invention, the first, second and third rollers and the medium supply container associated therewith form a first-medium applying device, and the plate cylinder, the other assembly of rollers and the other supply container form a supplementary medium-applying device, and means are included for operating the first medium-applying device simultaneously with the supplementary medium-applying device.

In accordance with an added feature of the invention, the medium is a lacquer.

Both medium-applying or lacquering devices are used simultaneously in order to attain a maximum coating thickness of the medium or lacquer at least at predetermined areas of the sheet.

Other features which are considered as characteristic for the invention are set forth in the appended claims.

Although the invention is illustrated and described herein as embodied in medium-applying device in a printing machine, it is nevertheless not intended to be limited to the details shown, since various modifications and structural changes may be made therein without departing from the spirit of the invention and within the scope and range of equivalents of the claims.

The construction and method of operation of the invention, however, together with additional objects and advantages thereof will be best understood from the following description of specific embodiments when read in connection with the accompanying single FIGURE of the drawing which is a diagrammatic elevational view of the printing machine having a first lacquering device and a doctor blade assembly arranged at an applicator roller and disposed in front of a delivery unit and, in accordance with the invention, having a supplementary lacquering device located above the first lacquering device.

Referring now to the FIGURE of the drawing, there is shown therein a last printing unit 1 of a printing machine having a conventional inking unit 2 and a conventional dampening unit 3. Following the last printing unit 1, in direction of feed of paper through the printing machine from the right-hand side to the left-hand side of the drawing FIGURE, is a duplex lacquering unit formed of a first lacquering device 4 and a supplementary lacquering device 5 disposed above the first lacquering device 4. Printed sheets are conveyed from the last printing unit 1 to the lacquering devices 4 and 5, respectively. After the consequent treatment or processing of the sheets by the lacquering devices 4 and 5, respectively, the sheets are conveyed further by a delivery chain 12 to a delivery pile 13.

The first lacquering device 4 includes a first roller 18 for taking up medium from a supply container 20, a second roller 19 for metering a quantity of the medium to be applied, and a third roller 14 for transferring the medium, the third roller having a continuous cylindrical surface with a rubber lining disposed thereon for directly applying the medium onto the sheet which is to be processed.

The supplementary lacquering device 5 disposed above the first lacquering device 4 is made up of a lacquer supply vessel or tank 8 wherein a dipping roller 7 rotates, and transfers lacquer successively to a metering roller 9, a distributor roller 10 and an applicator roller 11. The applicator roller 11 is in direct contact with a plate cylinder 6 which is provided with a flexible relief or letterpress plate 17 used for lacquering. The plate cylinder 6 transfers the lacquer applied thereto to the roller 14 which, in turn, is in contact with the sheet-transfer cylinder 15. The sheet-transfer cylinder 15 has non-illustrated grippers which are sunk below the outer cylindrical surface thereof i.e. the back of the gripper is disposed lower than the surface of the sheet which is to be processed. After the consequent processing has been performed, the cylinder 15 surrenders the sheet to the

delivery chain or conveyor 12 which then conveys it to the delivery pile 13.

Lacquer 16 is received in the supply tank 8 and serves for suitably treating or processing the sheet after it has been printed. During the rotation of the dipping roller 7, it picks up the lacquer 16 from the supply tank 8 and transfers the lacquer 16 to the metering roller 9. The applicator roller 11 disposed in contact with the metering roller 9 transfers the lacquer 16 to the relief or letterpress plate on the plate cylinder 6 which is formed with suitable recesses. The distributor roller 10 distributes the lacquer uniformly in lacquering regions provided on the applicator roller 11. The format-dependent lacquering operation is effected by means of non-illustrated conventional doctor-blade devices which are attachable to the metering roller 9.

The relief or letterpress plate disposed on the plate cylinder 6 is suitably furnished with surfaces required for the lacquering process. The lacquer 16 adheres to the raised surfaces of the relief plate and at these locations, is transferred to the roller 14. Further transfer of the lacquer is effected via the roller 14 directly to the sheet being printed which is located on the sheet-transfer cylinder 15.

With the foregoing embodiment of the invention, it is possible to provide non-illustrated means either to use the first lacquering unit 4 individually or, if specific breaks or discontinuities i.e. spacings, in the lacquer coating applied to the material being printed are required, to use the supplementary device 5 individually or, if special coating thicknesses of the lacqher is required, to use the duplex lacquering unit, namely both the first lacquering device 4 and the supplementary lacquering device 5 simultaneously.

There are claimed:

1. In a printing machine, a medium applicator disposed downstream of printing units of the machine, in the travel direction through the machine of a sheet being printed, the medium applicator having an assembly formed of a first roller for taking up medium from a supply container, a second roller for metering a quantity of the medium to be applied, and a third roller for transferring the medium, the third roller having a continuous cylindrical surface with a rubber lining disposed thereon for directly applying the medium onto the sheet, the three rollers being in constant meshing engagement with a sheet-transfer cylinder during application of the medium, the medium applicator further comprising a plate cylinder having a cylindrical surface and carrying a flexible relief plate having raised surfaces thereon, and another assembly of rollers for supplying medium from another supply container to said raised surfaces of said flexible relief plate, said plate cylinder being in operative engagement with the third roller.

2. Medium applicator according to claim 1 wherein the first, second and third rollers and the medium supply container associated therewith form a first-medium applying device, and said plate cylinder, said another assembly of rollers and said another supply container form a supplementary medium applying device, and further including means for operating said first medium applying device simultaneously with said supplementary medium applying device.

3. medium applicator according to claim 1 wherein the medium is a lacquer.

* * * * *

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United States Patent [19]
Frazzitta

[11] Patent Number: 4,779,557
[45] Date of Patent: Oct. 25, 1988

[54] COATER FOR A SHEET FED PRINTING PRESS

[76] Inventor: Joseph Frazzitta, 279 Cherry Pl., East Meadow, N.Y. 11554

[21] Appl. No.: 77,699

[22] Filed: Jul. 27, 1987

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 902,782, Dec. 4, 1986, abandoned, which is a continuation of Ser. No. 748,974, Jun. 26, 1985, abandoned.

[51] Int. Cl.⁴ B05C 1/02
[52] U.S. Cl. 118/46; 118/224; 118/249; 118/262
[58] Field of Search 118/46, 224, 249, 262; 101/419; 427/428

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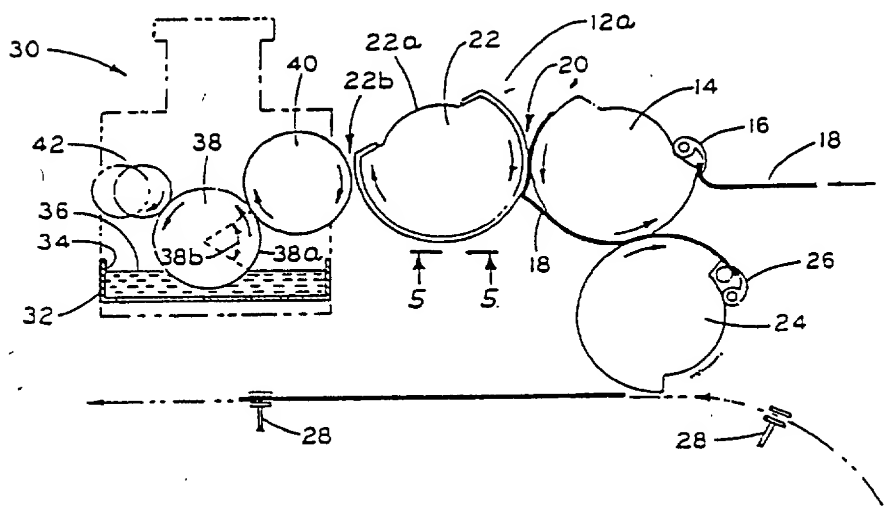
Primary Examiner—Evan K. Lawrence

[57] ABSTRACT

A coater for an offset printing press in which the last printing station, i.e., the blanket cylinder roller with its associated sheet-handling grippers, is converted to coating service, such that a pick-up roller, after an ascending arcuate path not exceeding 80°, transfers a liquid coating to an applicator roller rotating in an opposing direction to the blanket cylinder surface which coats the individual imprinted sheets and the liquid coating itself serves as a lubricant permitting said opposing directions of rotation and grippers of said blanket cylinder roller maintain proper handling control of the sheets during the coating thereof. Limiting the arcuate path of 80° obviates reverse flow of the liquid coating on the pick-up roller.

4 Claims, 3 Drawing Sheets



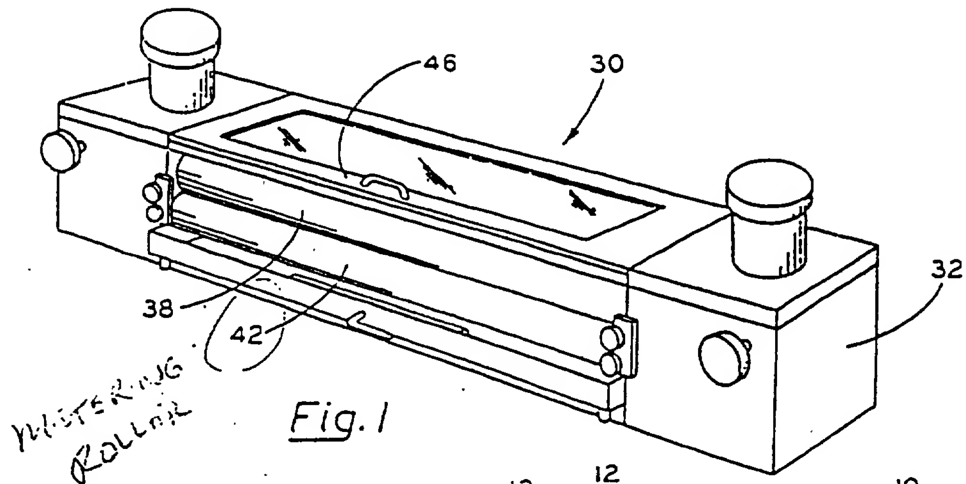


Fig. 1

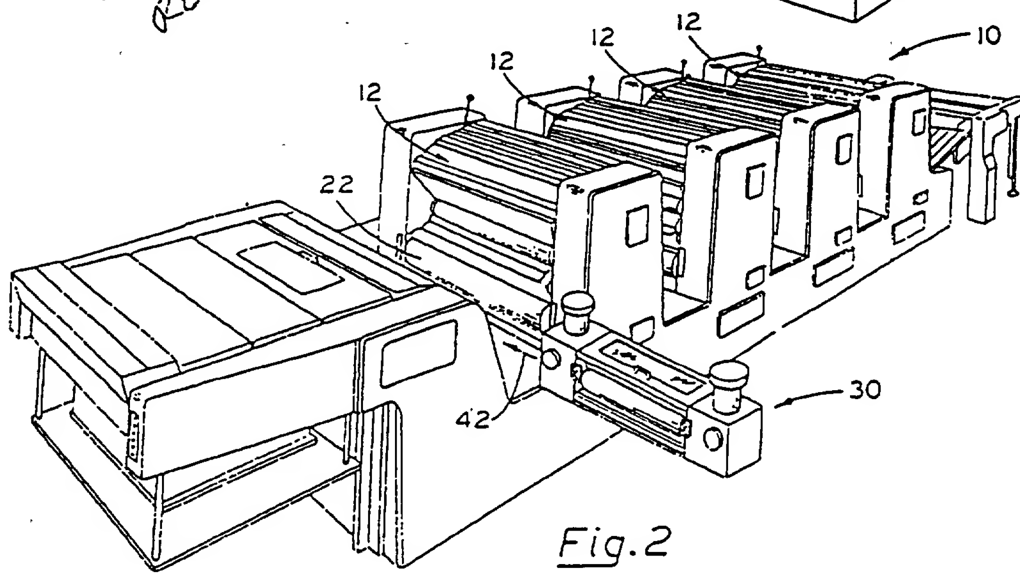


Fig. 2

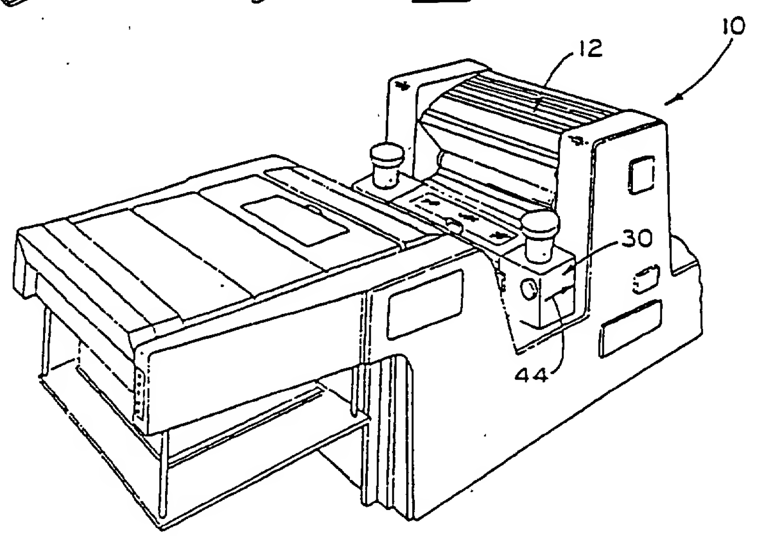


Fig. 3

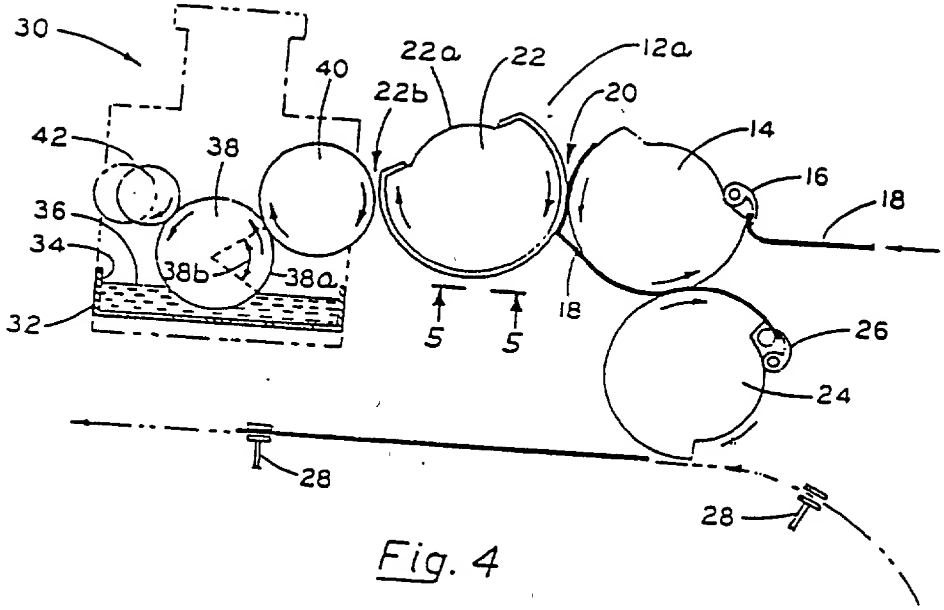


Fig. 4

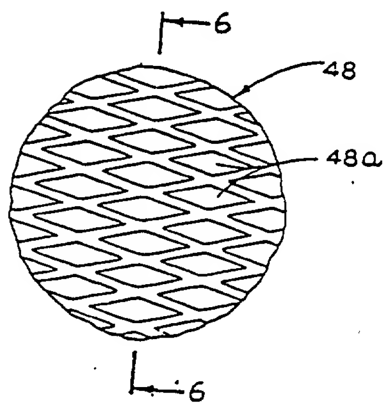


Fig. 5

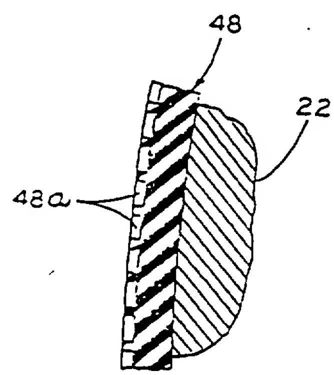
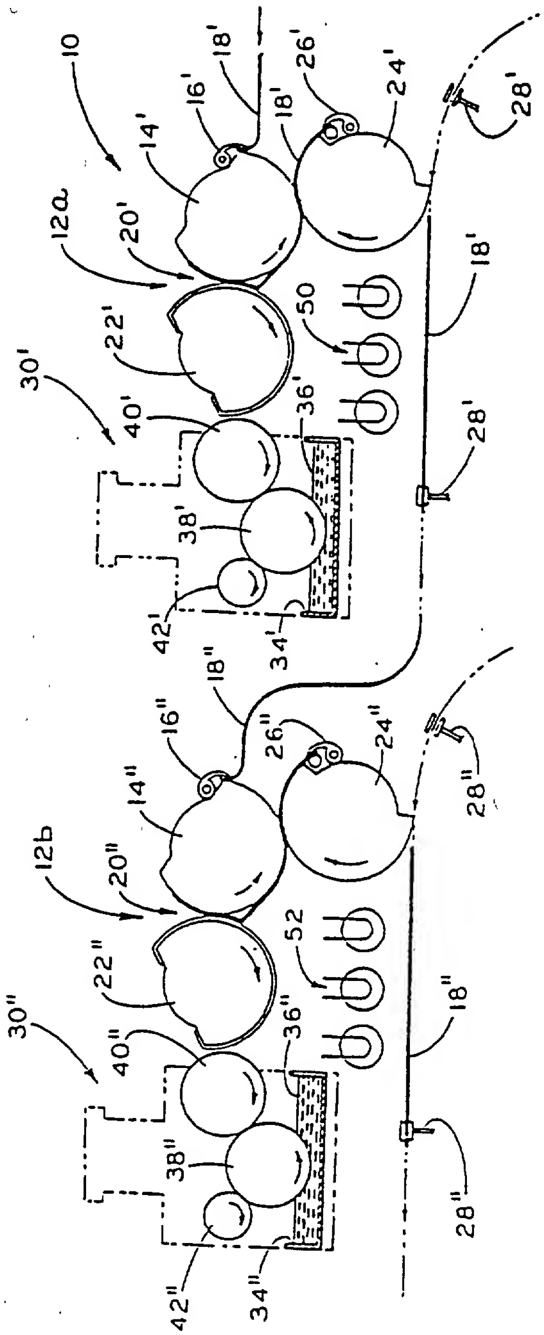


Fig. 6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12a
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16'
18'
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22'
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26'
28'
30'
34'
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12b
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16"
18"
20"
22"
24"
26"
28"
30"
34"
36"
38"
40"
42"
52

Fig. 7

COATER FOR A SHEET FED PRINTING PRESS

This is a continuation-in-part of application Ser. No. 902,782, filed Dec. 4, 1986, now abandoned, which is a continuation of application Ser. No. 748,974, filed June 26, 1985, now abandoned.

The present invention relates to improvements in coating individual sheets during the printing thereof in an offset printing press, and more particularly to a coating device for an offset printing press that effectively applies a aqueous, ultra-violet or other liquid coating to each imprinted sheet, in turn, without adversely affecting the printing operation of the printing press.

Applying liquid coating to printed material is, of course, already well known, and achieved using coating devices of well-known construction and modes of operation, as exemplified by the coating devices of U.S. Pat. Nos. 3,257,226, 3,029,780, and 3,951,102. These known coaters however are not noteworthy in their effectiveness and, most important, are not compatible with the operation of a standard offset printing press, to which the within invention is applied, as distinguished from a so-called web press. That is, the known coaters are restricted to use with said web press in which a continuous web is fed through the press and a significant degree of tension can therefore be exerted on the web as it is being printed. This ability to apply tension to a continuous web greatly facilitates the application of a coating thereto, whereas applying the same degree of tension to individually fed sheets of an offset printing press, an operating parameter which usually is required during the coating of the individul sheets, may inadvertently cause disengagement of the individual sheet from the grippers and thus seriously adversely affect the printing operation of the standard offset printing press.

Broadly, it is an object of the present invention to provide a coater for an offset printing press handling individually fed sheets overcoming the foregoing and other shortcomings of the prior art. More particularly, it is an object to utilize to advantage the sheet-handling apparatus of the printing press and to combine therewith a surface coating means, so that coating is effectively applied to the imprinted sheets while they are under the handling control of the printing press.

A coater demonstrating objects and advantages of the present invention is applied to a printing press of the type in which individual sheets are imprinted during passage through a nip between a cooperating blanket cylinder roller and an impression cylinder, said nip defining each of plural printing stations operatively arranged in series relation with each other. More particularly, the coater includes an operational mode that contemplates using the last encountered blanket cylinder roller for coating service, rather than printing, and operatively arranging same for counterclockwise direction rotation. Located adjacent the blanket cylinder roller is a storage container for a supply of a liquid coating to be applied to the individually printed sheets having a pick-up roller disposed with a lower portion in the liquid coating supply and operatively arranged for counterclockwise rotation for moving the liquid coating adhered to the surface thereof through an ascending arcuate path of less than 180 degrees, this restricted path being effective to obviate reverse direction flow of said liquid coating along said pick-up roller surface. Completing the rotating components is an applicator roller operatively arranged in contact with the pick-up roller along said arcuate path and also in contact with the blanket cylinder roller, said applicator roller being operatively arranged for clockwise rotation for maximizing the amount of liquid coating transferred thereto from the counterclockwise rotating pick-up roller at the respective surfaces of each which are either in light surface contact with each other or slightly spaced apart. In this way the imprinted sheets are individually coated during passage between the opposite direction rotating applicator and blanket cylinder rollers, said liquid coating serving as a lubricant permitting said opposing direction movements in said applicator and blanket cylinder rollers.

The above brief description, as well as further objects, features and advantages of the present invention, will be more fully appreciated by reference to the following detailed description of presently preferred, but nonetheless illustrative embodiments in accordance with the present invention, when taken in conjunction with the accompanying drawings, wherein:

FIG. 1 is a perspective view of a coating device which, in accordance with present invention, is used in cooperating conjunction with a blanket cylinder roller of a standard offset printing press;

FIG. 2 is also a perspective view and illustrates how the coating device of FIG. 1 is moved into its operative position with the blanket cylinder roller of said printing press;

FIG. 3 is a partial perspective view illustrating the operative position of said coating device at a printing station of said printing press;

FIG. 4 is a simplified side elevational view in longitudinal cross section illustrating structural details of the printing press and coating-applying cooperating rollers of the within invention;

FIG. 5 is a partial view as seen along lines 5—5 of FIG. 4 illustrating, on an enlarged scale, structural details of an elastomeric blanket of the blanket cylinder roller;

FIG. 6 is a view in cross section, taken along lines 6—6 of FIG. 5, showing further structural details of the surface of said blanket cylinder roller; and

FIG. 7 is a view similar to FIG. 4, but illustrating the application of two coatings to the sheet fed material at two printing stations.

Illustrated in FIG. 2 and partially in FIG. 3, will be understood to be a standard sheet fed offset printing press, generally designated 10. As is well understood, said standard offset printing press 10 includes plural printing stations, individually and collectively designated 12, at which a separate color is transferred to individual sheets providing a multi-color result. More particularly, and as will be explained in greater detail subsequently, on multi-color presses of which the printing press 10 will be understood to be an example, the transferring of a sheet from one printing station 12 to the next printing station located in line therewith, while keeping said sheet in exact register, is accomplished by means of transfer cylinders whose grippers are timed to take hold of the sheet before they are released by the previous cylinder gripper. For purposes of the within invention, it is important to note that the aforesaid operation of a standard offset printing press differs significantly from a so-called web press, in which a continuous web is fed through the press and a significant degree of tension can therefore be exerted on the web as it is being printed. This ability to apply tension to a continuous web greatly facilitates the application of a coating

thereto, whereas applying the same degree of tension to individually fed sheets of an offset printing press, an operating parameter which usually is required during the coating on the individual sheets, may inadvertently cause disengagement of the individual sheet from the grippers and thus seriously adversely affect the printing operation of the standard offset printing press.

An important contribution of the present invention therefore is the achievement of applying a coating to individually fed sheets of a standard offset printing press, such as press 10, without adversely affecting the printing operation of said press

The manner in which, in accordance with the present invention, individual fed sheets of an offset printing press are effectively coated, can best be appreciated by the simplified cross sectional view of FIG. 4, to which figure reference should now be made. In accordance with the present invention, the last encountered printing station 12, designated 12a in FIG. 4, is incorporated as part of the within inventive coating operation. Printing station 12a, as is well understood, is defined by an impression cylinder 14 having standard constructed and operating grippers 16 which effectively grip, in turn, the leading edge of each imprinted sheet 18. Rotation of the impression cylinder 14 carries the gripped sheet 18 to the nip 20 of said impression cylinder 14 and a cooperating blanket cylinder 22. When used for printing, the blanket cylinder 22 prior to the nip 20 receives an ink image from a printing plate (not shown) and effectively transfers this ink image to the sheet 18. In accordance with the present invention, however, the blanket cylinder 22 is not used for printing service, but is used for effectively applying a liquid coating to the individually fed sheets 18, said coating typically being an appropriate chemical for blocking adverse effects of ultra-violet rays or other aqueous coating, or may even be an acrylic water based coating to provide a gloss or otherwise enhance the appearance of the imprinted sheet. The coating may also accelerate the drying of the printing ink applied to the sheet.

Before describing how the liquid coating is applied, it is helpful to complete the description of the operation of the components of the printing press at station 12a. This operation is completed by a transfer cylinder 24 having grippers 26 which in a well understood manner engage the sheet 18 as it exits from the nip 20 and effectively transfers each sheet 18 to sheet-gripping devices 28 of a conveyor which delivers each sheet to a point of discharge.

Thus far what has been described, except for the use at station 12a of the blanket cylinder 22 for coating rather than printing service, is well understood and does not form an essential part of the within invention. The contribution of the within invention, which will now be described, consists of the coating device, shown in isolated perspective in FIG. 1 and generally designated 30 therein, which cooperates with and has an operative position in relation to the blanket cylinder 22, as shown in FIGS. 2, 3, and as now will be described in detail.

Still referring to FIG. 4, the coating device 30 includes a housing 32 which bounds a compartment 34 for the storage of a supply of the liquid coating 36 to be applied to the individual fed sheets 18. Appropriately journaled for rotation in the lower portion of the supply 36 is a pickup roller 38, which, because the blanket cylinder roller 22 is journaled for rotation in a clockwise direction, is itself journaled for rotation in a counterclockwise direction, the reasons for which different directions of rotation will soon be apparent. During counterclockwise rotation of the pickup roller 38, however, a liquid coating which adheres to its surface is raised through an ascending path 38a and is transferred therefrom before the path 38a is as long as 180 degrees. As a result, a liquid which is picked up on the surface of the pickup roller 38 does not travel through an arcuate path of such length that there is reverse flow (i.e., flow in a direction which is opposite the rotational direction of roller 38) in the picked-up liquid coating. Rather, at a point of ascending movement which does not exceed to only 80 degrees as noted by the angle 38b, surface contact is established with said pickup roller 38 by an applicator roller 40 appropriately journaled for rotation in a clockwise direction. Thus, at the surface contact established with the pickup roller 38, the clockwise rotation of applicator roller 40 is in a direction which most effectively transfers a maximum amount of liquid coating from said pickup roller 38 to its surface. On the side of the applicator roller 40 opposite from the pickup roller 38, the surface of the applicator roller is located in a range from being in light contact with the surface of the blanket cylinder 22 to a slight gap 22b spaced therefrom. This light contact or slightly spaced apart relationship of the surfaces of the rollers 40 and 22 is necessitated by the opposing directions of rotation of these rollers. Nevertheless, it has been found in practice that the liquid coating, which may consist of the chemical sold under the trademark SUN CURE by General Printing Ink, division of Sun Chemical of New Jersey, effectively serves as a lubricant which permits the opposing directions of rotation while at the same time there is an effective transfer of the liquid coating from the surface of the applicator roller 40 the surface of the blanket cylinder 22 even, under some operating conditions, across the slight gap 22b. Naturally, there is no transfer in the gap area 22a of the blanket cylinder 22 which gap area must be provided in order to register with the gap area that has to be incorporated in the construction of the impression cylinder 14 because of the grippers 16.

Completing the construction of the coating device 30 is a metering roller 42 which in an appropriate manner is mounted for movement in a clearance position shown in phantom perspective in FIG. 4 into an operative condition shown in full line in FIG. 4, in which latter position it makes contact with the pickup roller 38. The metering roller 42 is only in contact with the pickup roller 38 when the apparatus is running in a standard mode, but said metering roller 42 is disengaged from the pickup roller 38 when the latter is running in a reverse mode (i.e., counterclockwise), thus giving the operator the option of running in either the standard or reverse mode.

Referring now to FIGS. 2 and 3, it is noted for completeness' sake that at the last encountered printing station, which, according to the present invention, is to be used for coating rather than printing service, there is exposure of and therefor ready access to the blanket cylinder 22 of this station. The coating device 30 will be understood to be on appropriate support apparatus, not shown, so that is can be effectively moved from a clearance position to the side of the printing press 10 as shown in FIG. 2, into an operative in line position in the direction 42, said operative position being more particularly illustrated in FIG. 3. In the operative position of FIG. 3 it will then be understood that preferably using pneumatic cylinders which engage the device 30 in its

operative position, that said device is effectively moved in the direction 44 towards the blanket cylinder 22 so that light contact or the slight gap 22b is established with said blanket cylinder 22 and the previously referred to applicator roller 40 of the device 30.

As is perhaps best illustrated in FIG. 1, the coating device 30 includes, in addition to the components thereof previously described, a hinged top cover 46, which when opened provides access for making any repairs or replacements to the pickup roller 38, applicator roller 40 or metering roller 42, as well as to the motor which is operatively associated with the metering roller 42 for moving it from its clearance position into contact with the pickup roller 38 and also for the motor which is operatively engaged to drive the pickup roller 38 through rotation. Access through the opening of the cover 46 to the compartment 34 is also necessary for replenishing the liquid coating supply 36.

Special note is made in FIGS. 5 and 6 of a possible elastomeric blanket which is recommended for use for the blanket cylinder 22 to enhance its coating-applying efficiency. As shown in these figures, appropriately mounted about the periphery of the blanket cylinder 22 is an elastomeric blanket 48 having a pattern of surface depressions, individually and collectively designated 48a, which are effective in receiving acrosss the nip or gap 22b that previously was described as having been established between the applicator roller 40 and blanket 22, a maximum amount of the liquid coating 36 for transfer to the individual fed sheets 18 at the nip 20.

In the apparatus as illustrated and described in connection with FIGS. 2 and 3, the direction of the individual fed sheets 18 are from right to left, and thus the rotation direction of the blanket cylinders 22, including said cylinder at the coating station 12a, are in a clockwise direction. It should be readily appreciated, however, that if the delivery of the individually fed sheets 18 were from left to right, that the rotation direction of the blanket cylinders would be in a counterclockwise direction, and that the rotation directions of the moving components of the coating device 30 would then be in the opposite direction than that illustrated and described in connection with FIG. 4. Accordingly, it is to be understood that the within invention, and the claims defining same, contemplate both directions of rotation of the rotating components practicing said invention.

Referring now to FIG. 7, it will be further understood that the within invention contemplates applying a coating to the individual fed sheets 18 at two stations, rather than just one station, as illustrated and described in connection with FIGS. 1–6. A two-station coating process is particularly advantageous in order to achieve a high lamination appearance on the imprinted sheets 18. That is, as understood, in order to presently achieve a high gloss on an imprinted sheet, it is necessary to use a mechanical process in which a plastic film is laminated to the printed substrate. In accordance with the present invention, it is now possible to achieve such a result chemically, rather than mechanically. To do this, and as illustrated diagramatically in FIG. 7, the printing press 10 is modified to the extent of constructing an additional coating station 12b down the line from station 12a of FIG. 4. In all other respects, except as noted, the structure already described in connection with FIG. 4 is the same, and this similarity is indicated in FIG. 7 by the use of the same reference numerals with a single prime of coating station 12a, and a double prime at coating station 12b. The only structure added to the setup of FIG. 7 are infrared lamp dryers 50 and 52 located as illustrated at the coating stations 12a and 12b, respectively. The dryers 50 and 52 will be understood to be of conventional construction and mode of operation and, in lieu thereof, good results can also be achieved using convection hot air units.

Coating station 12a is preferred to coat the individual fed sheets 18 with an acrylic water base emulsion which is applied over the sheet 18 previously printed with an oil-based ink. Exposure of the sheet 18a to the infrared lamp dryers 50 achieve surface drying thereof. Previously, the drying of the aqueous or ultraviolet coating on the sheet 18a invariably resulted in a nominal gloss level in the printed sheet. As a result, it was standard practice to mechanically laminate a plastic film to the printed sheet to obtain a high gloss level in the surface thereof. In accordance with the system of FIG. 7, however, the mechanical lamination is eliminated and in its place there is provided in accordance with the present invention a second coating station 12b which preferably applies a high gloss photochemical epoxy resin coating to each individually fed sheet 18" which is transferred from station 12a to station 12b.

From the foregoing description of the system of FIG. 7, it should be readily appreciated that the process described and illustrated achieves a high gloss appearance in the imprinted sheets 12 that is the same as that achieved by mechanical lamination of plastic film and does so in much less time and without the equipment and apparatus necessary for a mechanical lamination process. The process of FIG. 7 utilizes already existing stations of a multi-station offset standard printing press modified in the manner herein illustrated and described to provide coating, rather printing service.

In the foregoing description, the reference to imprinted sheets and the application thereto of the within inventive coating methods is intended to have specific reference to chemically achieving an ultra high gloss surface over wet ink, an achievement which in the trade would be aptly called "wet trap in line", wherein the "wet trap" signifies achieving a dried ultra high gloss surface trapping wet inks on the paper substrate, and "in line" signifies achieving same during the normal offset printing process rather than, as now done in the prior art, mechanical bonding a plastic film to the printed sheet as a plastic film to the printed sheet as a separate operation.

However, the invention is not limited to a "wet trap in line process", and it is to be further understood that a latitude of modification, change and substitution is intended in the foregoing disclosure, and in some instances some features of the invention will be employed without a corresponding use of other features. Accordingly, it is appropriate that the appended claim be construed broadly and in a manner consistent with the spirit and scope of the invention herein.

What is claimed is:

1. A coater for a printing press of the type in which individual sheets are imprinted during passage between a cooperating blanket cylinder roller and an impression cylinder defining each of plural printing stations operatively arranged in series relation with each other, said coater comprising said last encountered blanket cylinder roller used for coating service rather than printing operatively arranged for clockwise direction rotation, a storage container for a supply of a liquid coating to be applied to said individually printed sheets, a pick-up roller having a lower portion disposed in said liquid

coating supply operatively arranged for counterclockwise rotation for moving said liquid coating adhered to the surface thereof through an ascending arcuate path not exceeding 80 degrees to obviate reverse direction flow of said liquid coating along said pick-up roller surface, and an applicator roller operatively arranged in contact with said pick-up roller to receive said liquid coating thereon adjacent the end of said arcuate path not exceeding 80° and also either in contact with, or spaced by a slight gap from, said blanket cylinder roller, said applicator roller being operatively arranged for clockwise rotation for maximizing the amount of liquid coating transferred thereto from said counterclockwise rotating pick-up roller at the respective surfaces of each in contact with each other and effectively further transferring said liquid coating thereon to said opposing direction moving surface of said blanket cylinder roller operatively arranged at a clearance position therefrom preparatory to said liquid coating being applied to said imprinted sheets at said last encountered printing station, said liquid coating serving as a lubricant permitting said opposing direction movements in said applicator and blanket cylinder rollers.

2. A coater for a printing press of the type in which individual sheets are imprinted during passage between a cooperating blanket cylinder roller and an impression cylinder defining each of said plural printing stations operatively arranged in series relation with each other, said coater comprising said last encountered blanket cylinder roller used for coating service rather than printing operatively arranged for counterclockwise direction rotation, a storage container for a supply of a liquid coating to be applied to said individually printed sheets, a pick-up roller having a lower portion disposed in said liquid coating supply operatively arranged for clockwise rotation for moving said liquid coating adhered to the surface thereof through an ascending arcuate path not exceeding 80 degrees to obviate reverse direction flow of said liquid coating along said pick-up roller surface, and an applicator roller operatively arranged in contact with said pick-up roller to receive said liquid coating thereon adjacent the end of said arcuate path not exceeding 80° and also either in contact with, or spaced by a slight gap from, said blanket cylinder roller, said applicator roller being opratively arranged for counterclockwise rotation for maximizing the amount of liquid coating transferred thereto from said clockwise rotating pick-up roller at the respective surfaces of each in contact with each other, and effectively further transferring said liquid coating thereof to said opposing direction moving surface of said blanket cylinder roller operatively arranged at a clearance position therefrom preparatory to said liquid coating being applied to said imprinted sheets at said last encountered printing station, said liquid coating serving as a lubricant permitting said opposing direction movements in said applicator and blanket cylinder rollers.

3. A pair of coaters for a printing press of the type in which individual sheets are imprinted during passage between a cooperating blanket cylinder roller and an impression cylinder defining each of plural printing stations operatively arranged in series relation with each other, said coaters comprising two sets of sequentially encountered blanket cylinder rollers used for coating service rather than printing operatively arranged for clockwise direction rotation, and for each said coater and its cooperating blanket cylinder roller, a storage container for a supply of a liquid coating to be applied to said individually printed sheets, a pick-up roller having a lower portion disposed in said liquid coating supply operatively arranged for counterclockwise rotation for moving said liquid coating adhered to the surface thereof through an ascending arcuate path not exceeding 80 degrees to obviate reverse direction flow of said liquid coating to receive said liquid coating thereon adjacent the end of said arcuate path not exceeding 80° and also either in contact with, or spaced by a slight gap from, said pick-up roller along said arcuate path and also in contact with said baanket cylinder roller, said applicator roller being operatively arranged for clockwise rotation for maximizing the amount of liquid coating transferred thereto from said counterclockwise rotating pick-up roller at the respective surfaces of each in contact with each other and effectively further transferring said liquid coating thereon to said opposing direction moving surface of said blanket cylinder roller operatively arranged at a clearance position therefrom preparatory to said liquid coating being applied to said imprinted sheets at each said encountered printing station, said liquid coating serving as a lubricant permitting said oppesing direction movements in said applicator and blanket cylinder rollers.

4. A pair of coaters for a printing press of the type in which individual sheets are imprinted during passage between a cooperating blanket cylinder roller and an impression cylinder defining each of plural printing stations operatively arranged in series relation with each other, said coaters comprising two sets of sequentially encountered blanket cylinder rollers used for coating service rather than printing operatively arranged for counterclockwise direction rotation, and for each said coater and its cooperating blanket cylinder roller, a storage container for a supply of a liquid coating to be applied to said individually printed sheets, a pick-up roller having a lower portion disposed in said liquid coating supply operatively arranged for clockwise rotation for moving said liquid coating adhered to the surface thereof through an ascending aruuate path not exceeding 80 degrees to obviate reverse direction flow of said liquid coating along said pick-up roller surface, and an applicator roller operatively arranged in contact with said pick-up roller to receive said liquid coating thereon adjacent the end of said arcuate path not exceeding 80° and also either in contact with, or spaced by a slight gap from, said blanket cylinder roller, said applicator roller being operatively arranged for counterclockwise rotation for maximizing the amount of liquid coating transferred thereto from said clockwise rotating pick-up roller at the respective surfaces of each in contact with each other and effectively further transferring said liquid coating thereon to said opposing direction moving surface of said blanket cylinder roller operatively arranged at a clearance position therefrom preparatory to said liquid coating being applied to said imprinted sheets to each said encountered printing station, said liquid coating serving as a lubricant permitting said opposing direction movements in said applicator and blanket cylinder rollers.

* * * * *

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United States Patent [19]

Kota

[11] **Patent Number:** **4,815,413**

[45] **Date of Patent:** **Mar. 28, 1989**

[54] **VARNISHING APPARATUS FOR PRINTED SHEET**

[75] Inventor: **Toshio Kota, Ibaraki, Japan**

[73] Assignee: **Komori Printing Machinery Co., Ltd., Japan**

[21] Appl. No.: **919,144**

[22] Filed: **Oct. 15, 1986**

[51] **Int. Cl.⁴** **B05C 1/02**

[52] **U.S. Cl.** **118/46;** 118/249; 118/262

[58] **Field of Search** 118/46, 231, 262, 249

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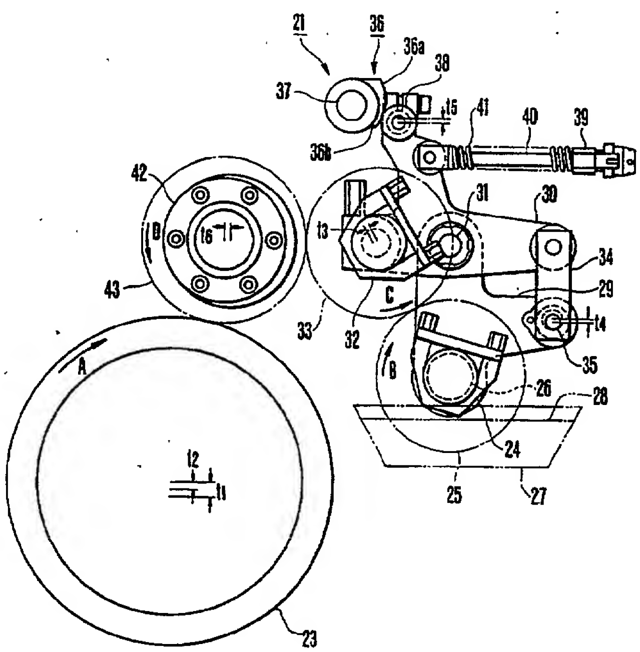
Primary Examiner—John McIntosh

Attorney, Agent, or Firm—Remy J. VanOphem

[57] **ABSTRACT**

A varnishing apparatus for a printed sheet includes: a metering roller, to a peripheral surface of which a varnish from a varnish duct is transferred; a form roller which is brought into contact with a downstream side of the metering roller and is rotated in the same direction as that of the metering roller to allow transfer of the varnish from the metering roller; and a rubber blanket cylinder which is brought into contact with a downstream side of the form roller and is rotated in a direction opposite to that of the form roller to allow transfer of the varnish from the form roller, the rubber blanket cylinder having a notch on its outer peripheral portion and transferring the varnish onto a sheet which is in contact with its peripheral surface. The surface of the metering roller is formed of an elastic material having a roughened surface.

7 Claims, 3 Drawing Sheets



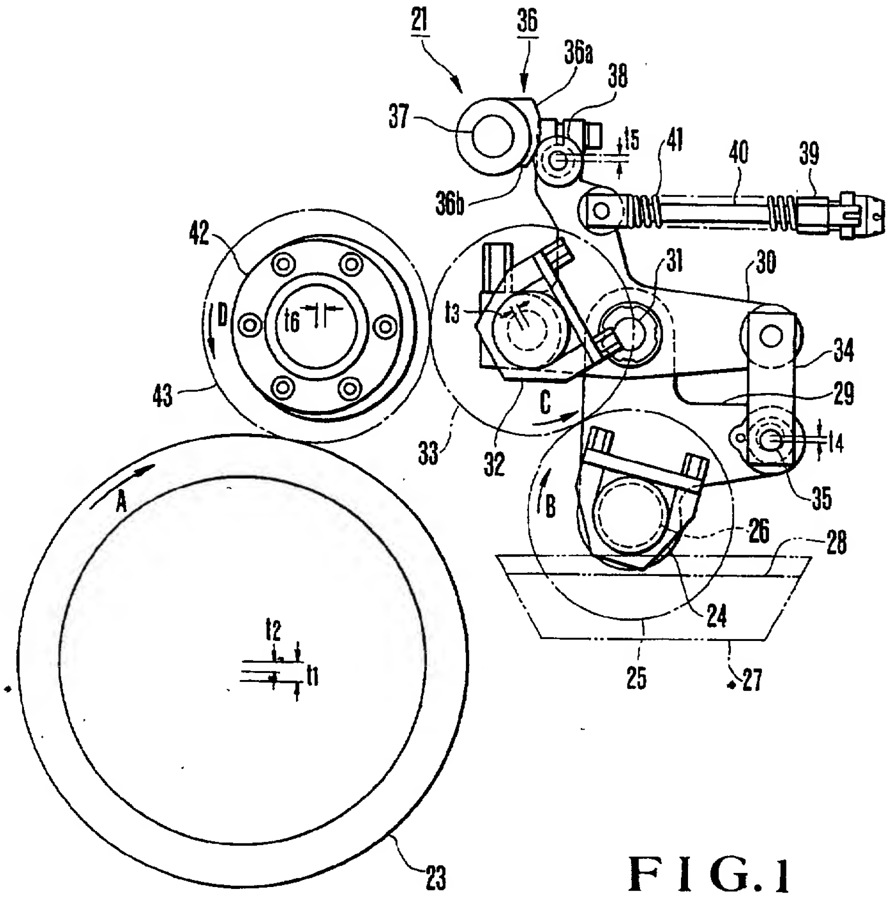

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FIG. 1

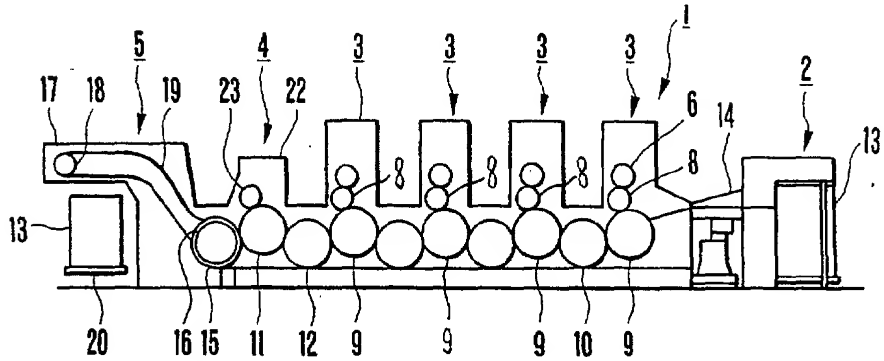
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FIG.2

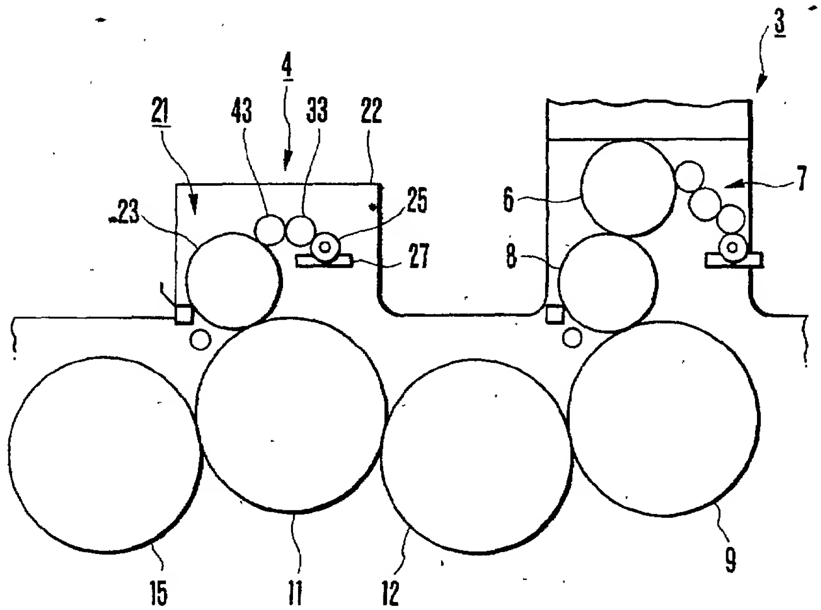
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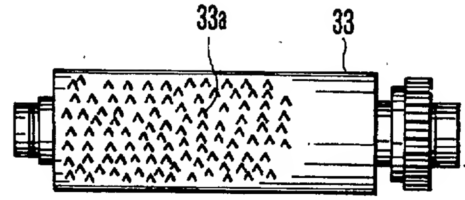
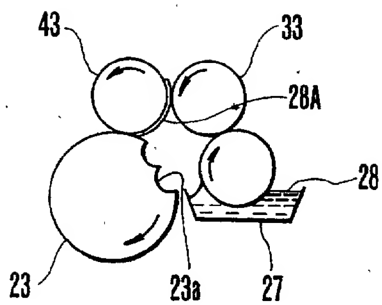
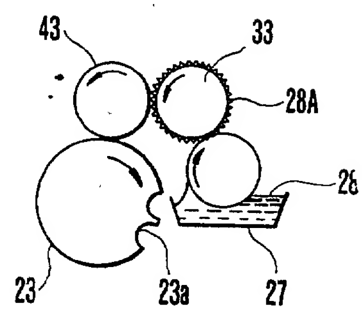
FIG.3



F I G.4



F I G.5(a)



F I G.5(b)

VARNISHING APPARATUS FOR PRINTED SHEET

BACKGROUND OF THE INVENTION

The present invention relates to a varnishing apparatus, arranged between a printing unit and a delivery unit of a rotary press, or in an independent varnishing machine, for varnishing a printed surface of a paper sheet after printing.

A printed surface of a sheet printed by a rotary press is easily contaminated with ink in the following process since the ink dries slowly. In the case of sheets, offset occurs while they are stacked after a delivery operation. In order to prevent this, a drying device can be arranged midway along a conveying path of the printed sheet or spray powder can be sprayed at this position. However, the drying device makes the entire apparatus bulky. On the other hand, when powder is sprayed, the surface of the sheet is roughened causing it to lose its gloss and this often interferes with the following printing. Alternatively, varnish is coated on the printed surface to prevent it from being contaminated and to put a gloss thereon. This is performed mainly for catalogs, pamphlets, and the like, which must have a good appearance.

The varnishing apparatus of this type is sometimes used as an independent varnishing machine. However, in recent years, due to poor work efficiency caused by, e.g., re-stacking of sheets, the varnishing apparatus is normally arranged midway along a delivery path of a rotary press. A typical varnishing apparatus includes a roller group having a roller arrangement similar to that of a dampening device for supplying dampening water to the surface of a printing plate mounted on a plate cylinder of a rotary press. Varnish contained in a varnish duct is supplied to the surface of a rubber blanket cylinder through the roller group, and the varnish is transferred from the rubber blanket cylinder to a sheet passing between the rubber blanket cylinder and an impression cylinder.

However, the rubber blanket cylinder of varnishing apparatus of this type has a notch on its outer periphery portion and the notch corresponds to that for grippers of the impression cylinder. Therefore, a portion, which corresponds to the notch, of varnish to be transferred from the upstream form roller to the rubber blanket cylinder, cannot be transferred and is left on the peripheral surface of the form roller as a thick varnish film. The thick varnish film is moved to the effective surface of the rubber blanket cylinder upon the next rotation, and is then coated on a sheet. Therefore, the varnish film cannot be uniformly coated on the sheet surface between the gripper end and the sheet end, resulting in irregular density in the circumferential direction of a sheet and degrading a product quality.

SUMMARY OF THE INVENTION

It is a principal object of the present invention to provide a varnishing apparatus which can form a uniform varnish film on a rubber blanket cylinder.

It is another object of the present invention to provide a varnishing apparatus which can supply an appropriate amount of varnish, so that a thick varnish film will not be left on a peripheral surface of a form roller.

In order to achieve the above objects, there is provided a varnishing apparatus for a -printed sheet having: a metering roller, to a peripheral surface of which a

varnish from a varnish duct is transferred a roller is brought into contact with a downstream side of the metering roller, and is rotated in the same direction as that of the metering roller to allow transfer of the varnish from the metering roller. A rubber blanket cylinder is brought into contact with a downstream side of the form roller and is rotated in a direction opposite to that of the form roller to allow transfer of the varnish from the form roller onto a peripheral surface thereof. The rubber blanket cylinder has a notch on its outer peripheral portion and transfers the varnish onto a sheet which is in contact with its peripheral surface, wherein a surface of the metering roller is formed of an elastic material having a roughened surface.

With the above arrangement, varnish transferred from a varnish duct to a metering roller is transferred to and coated on a sheet through a form roller and a rubber blanket cylinder, and varnish on the form roller facing the notch of the rubber blanket cylinder is not transferred to the rubber blanket cylinder and is left attached to the peripheral surface of the form roller to again face the peripheral surface of the metering roller. However, this varnish is pushed back and flattened by the roughened surface of the metering roller and is circulated while being held in the recessed portion of the roughened surface. Thus, almost no varnish is left on the form roller. Therefore, when the peripheral surface of the form roller faces the rubber blanket cylinder, almost no excess varnish will be transferred to the rubber blanket cylinder except for a normal transfer amount.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. 1 to 5 show a varnishing apparatus for a printed sheet according to an embodiment of the present invention, in which:

FIG. 1 is a side view of the apparatus;

FIG. 2 is a schematic side view of a four-color sheet rotary press to which the apparatus of the present invention is applied;

FIG. 3 is an enlarged side view of the main part of FIG. 2;

FIG. 4 is a front view of a metering roller; and

FIGS. 5(*a*) and 5(*b*) are side views for explaining the operation of the rollers.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

An embodiment of the present invention will now be described with reference to the accompanying drawings.

Referring to FIG. 2, a rotary press 1 includes a sheet feeder 2, four-color printing units 3, a varnishing unit 4, and a delivery unit 5. These units are separately assembled and are then combined with each other. Each printing unit 3 has a plate cylinder 6 on the peripheral surface of which a printing plate is mounted, an inking device (not shown) for supplying ink to a printing surface, and a dampening unit 7 for supplying dampening water. The plate cylinder 6 abuts against a rubber blanket cylinder 8 to which an image formed on the plate surface with ink and dampening water is transferred. Each printing unit 3 has an impression cylinder 9 having a diameter twice that of the rubber blanket cylinder 8 to be in contact therewith. In addition, a transfer cylinder 10 having the same diameter as that of the impression cylinder 9 is arranged between adjacent impression

cylinders 9 to be in contact therewith. In the varnishing unit 4, an impression cylinder 11 having the same diameter as that of the impression cylinder 9 is arranged at the same level as that of the other impression cylinders. A transfer cylinder 12 is also arranged between the impression cylinder 11 and the impression cylinder 9 for the fourth color. Sheets 13 stacked on a sheet stacker of the sheet feeder 2 are picked up by a sucker device (not shown) one by one, and are fed to a feedboard 14. Thereafter, each sheet is gripped by grippers of the impression cylinder 9 for the first color through a swing device (not shown). During a sheet conveyance the sheet is alternatively gripped by the grippers of the transfer cylinder 10 and the impression cylinder 9, with the result that images of four colors are printed thereon as the sheet passes through each pair of the rubber blanket cylinders 8 and the impression cylinders 9. Then, the sheet is gripped by the grippers of the impression cylinder 11 of the varnishing unit 4 and is wound therearound. The delivery unit 5 includes a delivery cylinder 15 contacting the impression cylinder 11 and a pair of coaxial sprockets 16. A pair of endless delivery chains 19 having a large number of delivery grippers arranged at equal intervals in the direction of travel of the sheet are looped between the sprockets 16 and sprockets 18 at the front end portions of a pair of delivery frames 17. The sheet 13 gripped by the gripper of the impression cylinder 11 is then gripped and conveyed by the grippers of the chains 19 and is released therefrom at the conveying end to be dropped and stacked on a sheet stacker 20.

The varnishing unit 4 of the press 1 with the above arrangement includes a varnishing apparatus 21 described below. More specifically, a rubber blanket cylinder 23 which has the same diameter as that of the rubber blanket cylinder 8 and around which a blanket is wound is axially supported by right and left frames 22 through double-structured bearings (not shown). The rubber blanket cylinder 23 is coupled to a motor and is rotated in a direction indicated by arrow A in FIG. 1. The respective outer diameter central axes of double-structured bearings for axially supporting the rubber blanket cylinder 23 are eccentrical with that of the rubber blanket cylinder 23, as indicated by reference symbols t_1 and t_2. When the bearings are pivoted by an air cylinder an the like, the rubber blanket cylinder 23 can be brought into contact with or removed from the impression cylinder 11, and a contacting pressure between the impression cylinder 11 and rubber blanket cylinder 23 can be adjusted.

Bearings 24 supported to extend inward from the right and left frames 22 rotatably support the two ends of a shaft 26 of a duct roller 25. The duct roller 25 is dipped in a varnish 28 in a varnish duct 27 extending between the frames 22. The duct roller 25 is driven by motor (not shown) through gears and is rotated in a direction indicated by arrow B in FIG. 1. A pair of roller arms 29 are loosely mounted on the shaft portions of the bearings 24 between the end faces of the duct roller 25 and the frames 22. An inverted T-shaped arm 30 is swingably mounted on one free end portion of each roller arm 29 through a pin 31. A bearing 32 having an eccentrical bearing portion as indicated by reference symbol t_3 is fixed to one free end portion of each T-shaped arm 30 to allow pivot adjustment. The bearings 32 pivotally support a metering roller 33 so that the peripheral surface of the metering roller 33 abuts against that of the duct roller 25. The metering roller 33 is coupled to the duct roller 25 through gears (not shown), and is rotated in a direction indicated by arrow C in FIG. 1. In addition, when the bearings are pivoted by loosening bolts, a nip pressure between the duct roller 25 and metering roller 33 can be adjusted. One roller arm 29 and one T-shaped arm 30 are coupled to each other through a lever 34 having an eccentrical portion indicated by reference symbol t_4 at its one end. When a pin 35 arranged at the eccentrical portion of the lever 34 is manually pivoted, the metering roller 33 can be brought into contact with or removed from the duct roller 25.

A surface portion 33*a* of the metering roller 33 is formed of an elastic material, e.g., synthetic rubber having a hardness of 20° or higher where "°" indicates the conventional JIS standard for hardness, and a hydrophilic and a hydrophi-lic property. The surface of the elastic material is roughened by a rotary grinder or a buff for grinding. The roughness of the roughened surface 33*a* is set to be 50 to 500% mesh in this embodiment that is, a surface roughness corresponding to a mesh of 50 to 500 lines per inch.

A cam 36 has a large diameter portion 36*a* and a small diameter portion 36*b*, and is fixed to a cam shaft 37 extending between the frames 22. The cam surface of the cam 36 is brought into contact with a roller 38 which is pivotally mounted on the free end portion of each T-shaped arm 30 to allow eccentricity adjustment, as indicated by reference symbol t_5. A stud 39 projecting from each frame 22 axially supports a spring shaft 40 which is capable of pivot adjustment and one end of which is pivotally mounted on the T-shaped arm 30. The T-shaped arm 30 receives a pivoting force from a compression coil spring 41 on the spring shaft 40 for pressing the roller 38 against the cam surface of the cam 36. When the cam shaft 37 is pivoted by an air cylinder (not shown), the metering roller 33 is brought into contact with or removed from the duct roller 25 through the cam 36, the roller 38, and the T-shaped arm 30.

An eccentric bearing 42 in which an outer diameter central axis is eccentric from the inner diameter central axis as indicated by reference symbol t_6 is arranged above the rubber blanket cylinder 23 to be axially supported by the frames 22. The eccentric bearing 42 axially supports a form roller 43 so that the peripheral surface of the form roller 43 is brought into contact with that of the rubber blanket cylinder 23. When the eccentric bearing 42 is pivoted by an air cylinder (not shown), the form roller 43 is brought into contact with or removed from the rubber blanket cylinder 23. The form roller 43 is coupled to the motor for driving the duct roller 25 through a one-way clutch and gears (neither of which are shown). The form roller 43 can be driven only by the motor to be rotated in a direction indicated by arrow D in FIG. 1.

The operation of the varnishing apparatus 21 with the above arrangement will now be described. When a varnishing operation is performed, the motor for driving the duct roller 25 is started in an impression throw-off state, and the cam 36 is pivoted by the air cylinder. Thus, the roller 38 faces the small diameter portion 36*b* of the cam 36, and the metering roller 33 is pressed against the duct roller 25 and the form roller 43 by the biasing force of the compression coil spring 41. At this time, since the eccentric bearing 42 is pivoted, the form roller 43 is located at a contact position. However, the rubber blanket cylinder 23 is located at its non-contact

position upon pivotal movement of its bearing. Therefore, the form roller 43 is separated from the rubber blanket cylinder 23. Rotation of the motor is transmitted to the duct roller 25 and the metering roller 33 through the gears, and is also transmitted to the form roller 43 through the one-way clutch and the gears. Note that the rubber blanket cylinder 23 is separated apart from the impression cylinder 11 and is stopped.

When the respective rollers are rotated, the varnish 28 in the varnish duct 27 is picked up by the duct roller 25, and is transferred to the metering roller 33 while its film thickness is adjusted by the contacting force of the metering roller 43. Thereafter, the varnish 28 is transferred to the form roller 33 and is then circulated between the metering roller 33 and duct roller 25.

When the press is rotated to feed the sheet 13 onto the feedboard 14 by the sheet feeder 2, the sheet 13 is conveyed, and the rubber blanket cylinder 8 of the printing units 3 is thrown on, thus performing four-color printing between the rubber blanket cylinders 8 and the impression cylinders 9. Thereafter, the sheet 13 is conveyed toward the varnishing unit 4. When the sheet 13 reaches the varnishing unit 4, the bearing is pivoted upon instruction from a timing generator to throw on the rubber blanket cylinder 23, so that the rubber blanket cylinder 23 is pressed against the impression cylinder 11 and the form roller 43. Therefore, the varnish circulating between the form roller 43 and duct roller 25 is transferred to the rubber blanket cylinder 23, and is transferred to and coated on the sheet 13 fed between the rubber blanket cylinder 23 and the impression cylinder 11. The varnished sheet 13 is conveyed by the delivery chains 19, and is stacked on the sheet stacker 20. In the impression throw-on state of the rubber blanket cylinder 23, rotation of the motor is kept transmitted to the form roller 43 through the one-way clutch, and the rotation of the rubber blanket cylinder 23 is also transmitted to the form roller 43 through the gears and the other one-way clutch upon throwing-on of the rubber blanket cylinder 23. In this case, since the rotating speed of the rubber blanket cylinder 23 is higher than that of the motor, the rotation is transmitted only by one one-way clutch, and the other one-way clutch is rotated idle.

After the varnishing operation, the sheet-feed operation is stopped, so that the sheet stacker 20 of the delivery unit 5 is exchanged for an empty one, or a paper size is changed, or the blanket is adjusted. Then, the rubber blanket cylinder 8 of the printing units 3 is thrown off and, at the same time, the rubber blanket cylinder 23 of the varnishing apparatus 21 is thrown off with respect to the impression cylinder 11 and the form roller 43. At this time, although the metering roller 33 is kept rotated so as not to solidify the varnish, the explanation of this operation is omitted.

After the above operation or adjustment, the sheet-feed operation is restarted. When the sheet 13 reaches the rubber blanket cylinder 23, the air cylinder is operated at a predetermined timing upon instruction from the timing generator. Then, the roller 38 is pressed against the large diameter portion 36*a* of the cam 36, and the rubber blanket cylinder 23 is thrown on. Therefore, the form roller 43 is urged against the rubber blanket cylinder 23 at a contacting pressure determined by the cam 36 and the roller 38, and is recovered to a varnishing state before the sheet-feed operation is stopped.

In the varnishing apparatus 21 operated as described above, a notch 23*a* as an ineffective portion corresponding to each of the notches for the grippers of the impression cylinder 11 is formed on the outer peripheral surface of the rubber blanket cylinder 23, as shown in FIG. 5(*a*). By the way, the impression cylinder is twice as large in diameter as the blanket cylinder and is provided with two notches located at diametrically opposite positions. When the rubber blanket cylinder 23 and the form roller 43 are rotated in the directions respectively indicated by arrows A and D, the varnish corresponding to the notch 23*a* is mixed with a new varnish film without being transferred to the rubber blanket cylinder 23 and becomes a thick varnish film 28A. Thus, the varnish film 28A is left on the form roller 43 and passes through the contacting point with the metering roller 33. In this case, in the conventional apparatus described previously, the thick varnish film 28A is left on the form roller 43 and is then transferred to the peripheral surface of the rubber blanket cylinder 23 during the next rotation, thus causing uneven coating. However, in the apparatus of this embodiment, the metering roller 33 and the form roller 43 are rotated in the same direction, and the surface portion 33*a* of the metering roller 33 is roughened, as shown in FIGS. 4 and 5(*b*). Therefore, the thick varnish film 28A to be left on the form roller 43 is pushed backward and flattened by the roughened surface portion 33*a* of the metering roller 33 which is circulated while being in sliding contact with the form roller 43. In addition, since the varnish becomes attached to the metering roller 33 to be held in the recess portion of the roughened surface, it will not be left on the form roller 43. The varnish film 28A returned to the metering roller 33 merges with the varnish 28 picked up by the duct roller 25 and the film thickness is adjusted by the nip pressure therebetween.

Note that the number of rollers and the arrangement thereof are not limited to those in the above embodiment. The metering roller, the form roller, and the rubber blanket cylinder need only be brought into contact with each other in this order from the upstream side, and the number of other rollers and the arrangement thereof can be desirably determined. In the above embodiment, the case has been exemplified wherein the varnishing apparatus is installed in the four-color press. However, the present invention can be applied to any color press or can be independently used.

According to the present invention as described above, in a varnishing apparatus for a printed sheet, a metering roller, a form roller, and a rubber blanket cylinder having a notch on its outer peripheral surface are arranged in this order from a varnish duct, so that their outer peripheral surfaces are brought into contact with each other. The form roller and the rubber blanket cylinder are rotated in opposite directions to sequentially transfer a varnish from the varnish duct. Thereafter, the varnish is transferred to and coated on a sheet contacting the rubber blanket cylinder. Since the surface portion of the metering roller is formed by an elastic material having a roughened surface, when the varnish is transferred between the form roller and the rubber blanket cylinder, the varnish corresponding to the notch of the rubber blanket cylinder is left on the form roller without being transferred to the rubber blanket cylinder. Therefore, even if the varnish left on the form roller is circulated toward the contacting point with the metering roller, it is flattened and pushed back by the metering roller having the roughened peripheral surface and is held in the recess portion of the roughened surface to be left on the metering roller. Therefore,

since virtually no varnish is left on the form roller and a fresh film of varnish is supplied to the form roller from the metering roller, uneven coating will not occur on the varnished surface of a printed sheet. In addition, since the varnish can be coated uniformly, product quality of the printed sheet can be greatly improved.

What is claimed is:

1. A varnishing apparatus for a printed sheet comprising:

a varnish duct for containing a varnish;

a metering roller having a roughened peripheral surface portion roughened peripheral surface portion being formed of an elastic material;

transfer means located between said varnish duct and said metering roller for selectively transferring said varnish from said varnish duct to said roughened peripheral surface portion of said metering roller;

a form roller which is selectively in contact with said metering roller, said form roller having a peripheral outer surface, said form roller being rotated in said first direction to allow transfer of said varnish from said roughened peripheral surface of said metering roller to said peripheral outer surface of said form roller;

a rubber blanket cylinder which is selectively in contact with said peripheral outer surface of said form roller, said rubber blanket cylinder having an outer peripheral surface, said rubber blanket cylinder being rotated in a direction opposite said first direction to allow transfer of said varnish from said peripheral outer surface of said form roller onto said outer peripheral surface of said rubber blanket cylinder, said rubber blanket cylinder transferring said varnish onto said printed sheet when said printed sheet is in selective contact with said outer peripheral surface of said rubber blanket cylinder;

means adjacent said metering roller for rotating said metering roller;

means adjacent said form roller for rotating said form roller; and

means adjacent said rubber blanket cylinder for rotating said rubber blanket cylinder.

2. An apparatus according to claim 1, wherein said elastic material is synthetic rubber having a hardness of not less than 20° and a hydrophilic property.

3. An apparatus according to claim 1, wherein said roughened peripheral surface of said metering roller is formed by a rotary grinder disk.

4. An apparatus according to claim 3, wherein said roughened peripheral surface of said metering roller has a roughness of 50 to 500 lines per inch.

5. An apparatus according to claim 4, wherein said varnishing apparatus is connected to a four-color rotary press and said printed sheet is provided by said four-color rotary press.

6. An apparatus according to claim 1, wherein said roughened peripheral surface is formed by buffing.

7. An apparatus according to claim 1, wherein said means for rotating said metering roller includes means for selectively transferring said varnish from said peripheral outer surface of said form roller to said outer peripheral surface of said rubber blanket cylinder.

* * * * *

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United States Patent [19]

Terasaka et al.

[11] Patent Number: 4,852,515

[45] Date of Patent: Aug. 1, 1989

[54] DEVICE FOR AUTOMATICALLY CONTROLLING COATING AMOUNT FOR USE IN COATING MACHINE

[75] Inventors: Yoshiyasu Terasaka, Ibaraki; Masao Tanabe, Osaka, both of Japan

[73] Assignee: Chugai Ro Co, Ltd., Japan

[21] Appl. No.: 875,624

[22] Filed: Jun. 18, 1986

Related U.S. Application Data

[63] Continuation of Ser. No. 610,691, May 16, 1984, abandoned.

[30] **Foreign Application Priority Data**

May 25, 1983 [JP] Japan 58-93247

[51] Int. Cl.[4] B05C 11/00

[52] U.S. Cl. 118/663; 118/262; 72/16; 100/47

[58] Field of Search 118/663, 262; 101/247; 100/47, 50; 72/16, 18

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Primary Examiner—Shrive Beck

Assistant Examiner—Alain Bashore

Attorney, Agent, or Firm—Jackson & Jones

[57] ABSTRACT

A device for automatically controlling coating amount for use in a coating machine including a backup roll, an applicator roll, a pickup roll, a base, a first table slidably mounted on the base and a second table slidably mounted on the first table. The device includes first and second pressure adjusting mechanisms for adjusting a pressure between the backup roll and the applicator roll and a pressure between the applicator roll and the pickup roll. Each of the first and second pressure adjusting mechanisms further includes a sensor, a stepping motor and a precision ball bearing screw member.

13 Claims, 4 Drawing Sheets

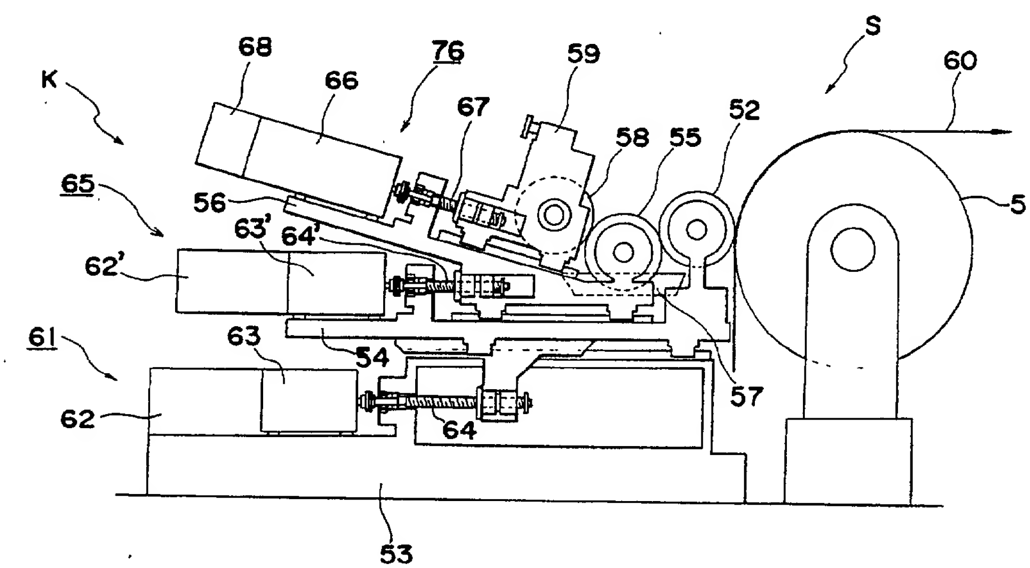


Fig. 1 PRIOR ART

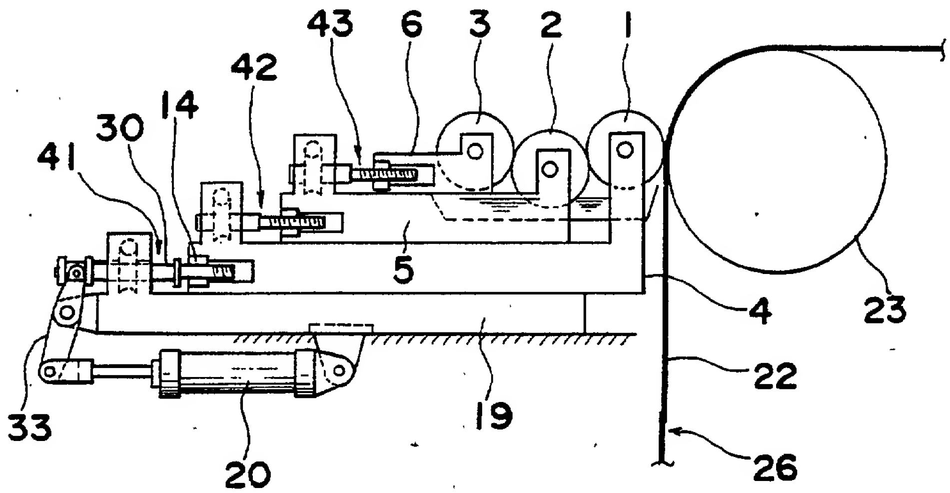
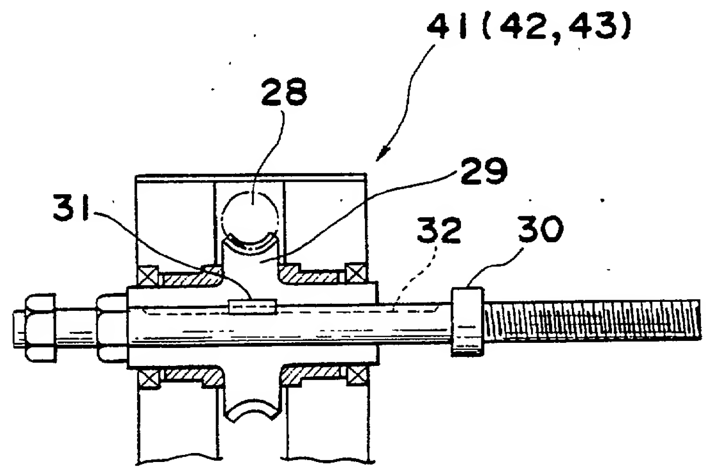


Fig. 2 PRIOR ART



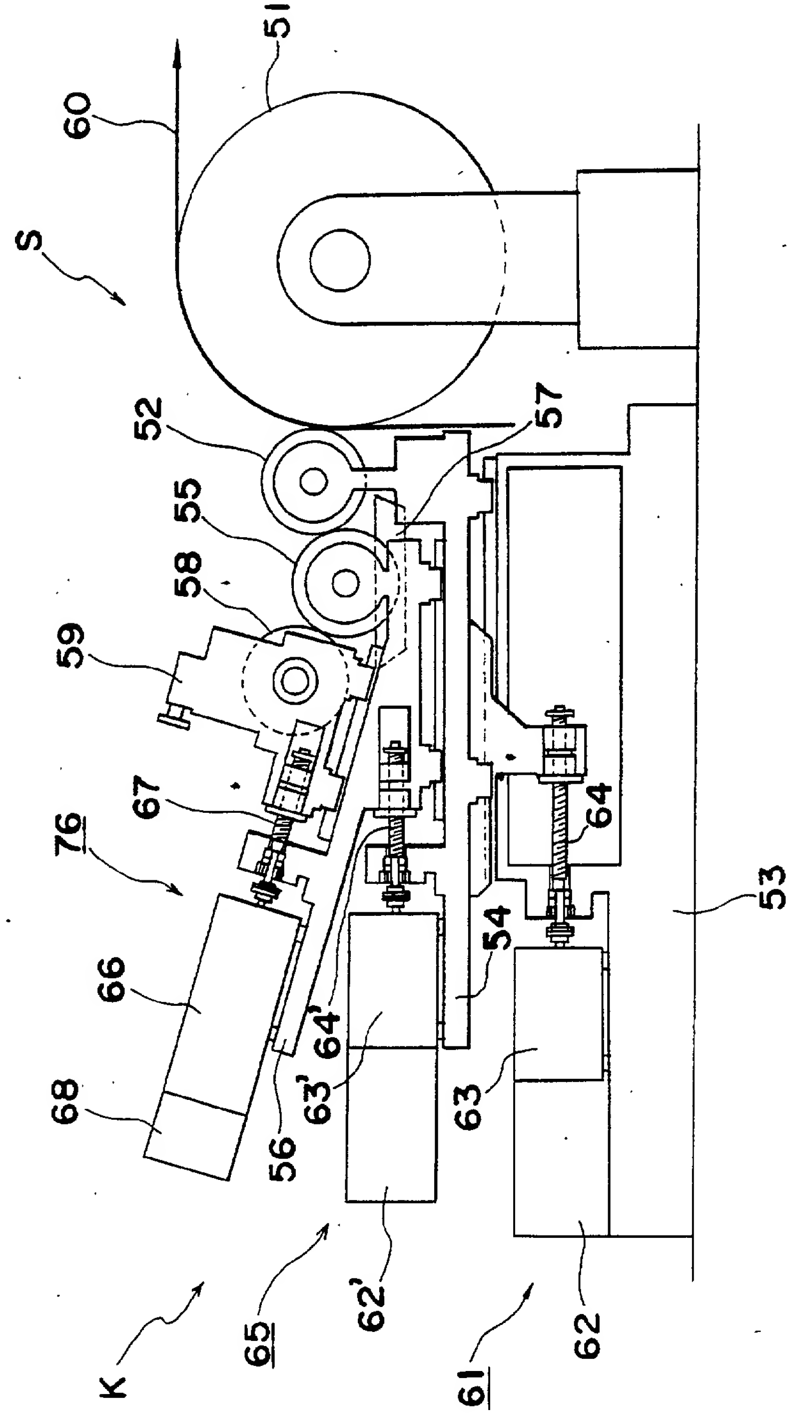


Fig. 3

Fig. 4

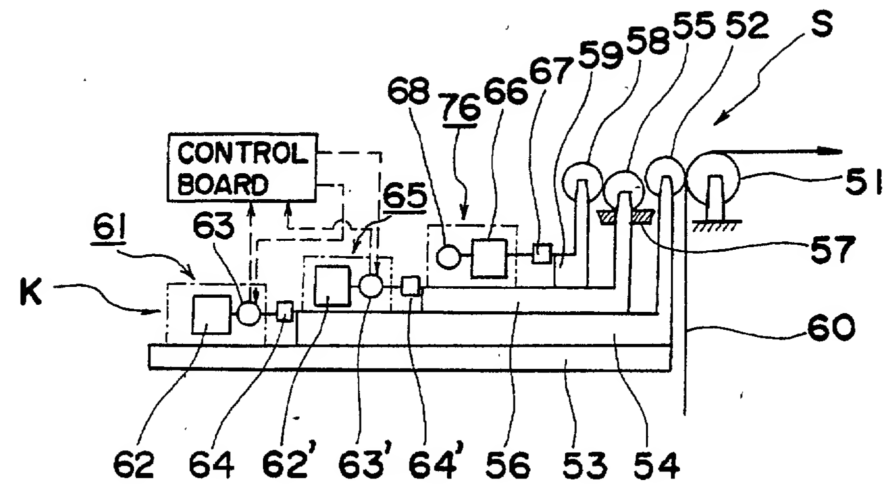

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Fig. 5

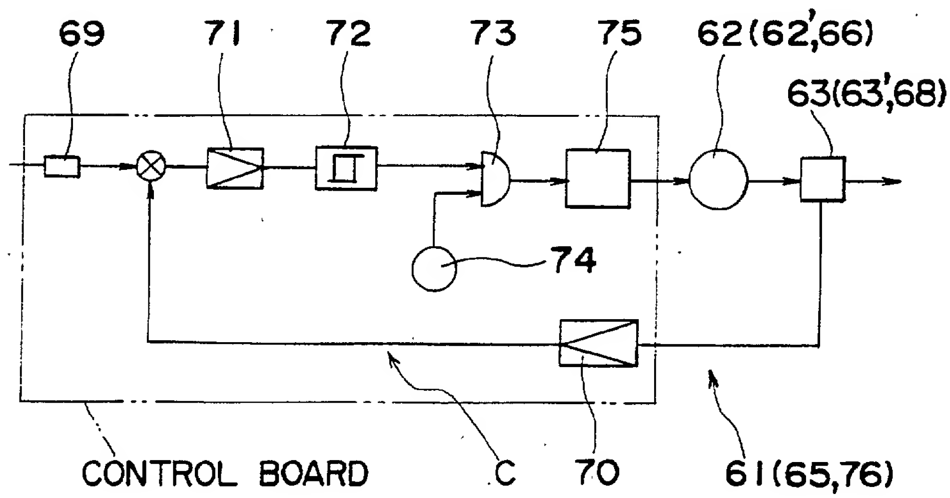
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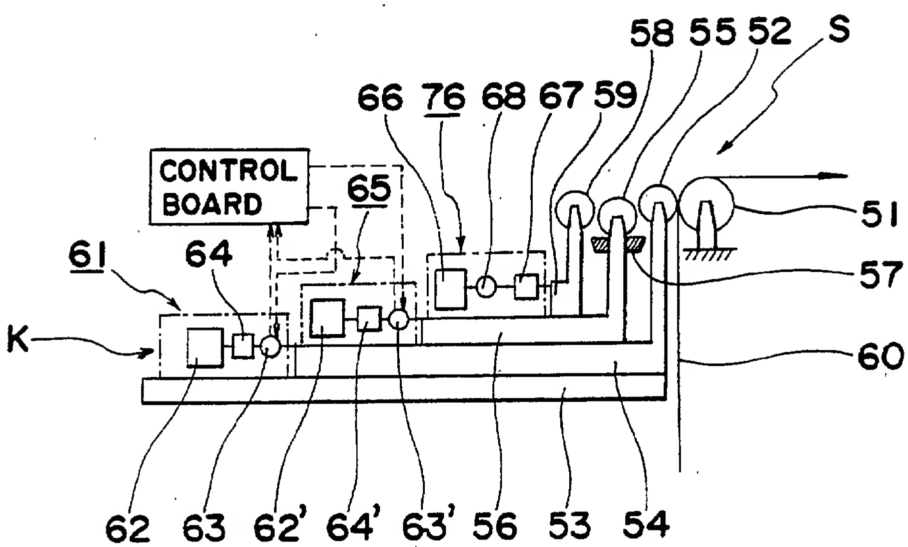
Fig. 6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DEVICE FOR AUTOMATICALLY CONTROLLING COATING AMOUNT FOR USE IN COATING MACHINE

This is a continuation of application Ser. No. 610,691, filed May 16, 1984, now abandoned.

BACKGROUND OF THE INVENTION

The present invention generally relates to a coating machine and more particularly, to a device for automatically controlling coating amount for use in the coating machine.

As shown in FIGS. 1 and 2, conventionally, in coating machines, it has been so arranged as disclosed, for example, in Japanese Laid-Open Utility Model Application No. 131869/1982 (Jikkaisho 57-131869) that an applicator roll 1 for applying paint to a sheet-like workpiece 22 pressed onto a backup roll 23 is secured to a first table 4. A pickup roll 2 for picking up paint stored in a pickup pan is secured to a second table 5, while a metering roll 3 is secured to a third table 6. The first table 4, the second table 5 and the third table 6 are slidably mounted on a base 19. Furthermore a first pressure adjusting mechanism 41 adjusts the contact pressure between the backup roll 23 and the applicator roll 1 by moving the first table 4 relative to the base 19. Mechanism 41 is mounted on the base 19 and engages the first table 4. A second pressure adjusting mechanism 42 adjusts the contact pressure between the applicator roll 1 and the pickup roll 2 by moving the second table 5 relative to the first table 4. Mechanism 42 is mounted on the first table 4 and engage the second table 5. A third pressure adjusting mechanism 43 adjust a contact pressure between the pickup roll 2 and the metering roll 3 by moving the third table 6 relative to the second table 5. Mechanism 43 is mounted on the second table 5 and engages the third table 6. Thus, thickness of a coating film on the workpiece 22 can be adjusted by operating the first, second and third pressure adjusting mechanisms 41, 42 and 43.

It should be understood that the applicator roll 1 is required to be quickly retracted away from the backup roll 23 just before a seam 26 of the workpiece 22 passes therebetween. To this end, a cylinder 20 is attached to the base 19 and is coupled with the first pressure adjusting mechanism 41 through a lever 33. Just before the seam 26 of the workpiece 22 passes between the backup roll 23 and the applicator roll 1, the first table 4 is quickly moved relative to the base 19 by the cylinder 20 in the leftward direction in FIG. 1, whereby the applicator roll 1 is quickly retracted away from the backup roll 23.

As best shown in FIG. 2, each of the first and second pressure adjusting mechanisms 41, 42 and 43 comprises a worm gearing composed of a worm 28 and a worm wheel 29, a rotary device (not shown) such as a hydraulic motor, a DC motor, etc. for driving the worm 28, a screw shaft 30 and a nut 14 (FIG. 1). The screw shaft 30 is unrotatably but axially movably mounted in the worm wheel 29 by a key 31 fitted into a key way 32 of the screw shaft 30 and is attached, at one end thereof, to the level 33. The first, second pressure adjusting mechanisms and the 41, 42 and 43 are operated by means of a manual handle based on skill of an operator. Thus, the prior art pressure and adjusting mechanisms have the disadvantages that skill of the operator is required for the operation and it is impossible to maintain each of the pressures between adjacent ones of the backup roll, the applicator roll, the pickup roll and the metering roll and the pickup roll at predetermined pressure values. Furthermore, the known pressure and adjusting mechanisms have such inconveniences that it is extremely difficult to operate them at higher speed and make them larger in size. Meanwhile, the known pressure adjusting mechanisms have been disadvantageous in that it is impossible to cope with minute changes in each pressure and the clearance due to rotation, swell, etc. of each roll. Moreover, the prior art pressure adjusting mechanisms have such a disadvantage that, in case each of the first, second and third tables are driven by a hydraulic motor or a DC motor through the worm gearing having a considerable play, it is impossible to accurately control each of contact pressures between adjacent ones of the rolls in forward and reverse rotations of the worm gearing. In addition, the known pressure adjusting mechanisms have such an inconvenience that, when a restrictive torque is continuously generated in the DC motor, its commutator is heated, thereby resulting in seizing thereof.

SUMMARY OF THE INVENTION

Accordingly, an essential object of the present invention is to provide an improved device for automatically controlling coating amount for use in a coating machine, in which each of contact pressures between adjacent rolls is detected as a detection signal, by a pressure sensor. The sensed pressure of each pair is compared with a preset value and then, a stepping motor is rotated forwardly or reversely through a step angle on the basis of a comparison signal which indicates the difference between the detection signal detected by the sensor and the present value such that each roll is moved toward or away from a corresponding neighboring one of the rolls. The roll movement is accomplished by a precision ball screw upon rotation of the stepping motor, whereby contact pressures between adjacent rolls, i.e., thickness of a coating film on a workpiece can be adjusted, with substantial elimination of the disadvantages inherent in conventional adjusting mechanisms of this kind.

Another important object of the present invention is to provide an improved device of the above prescribed type which is highly reliable in actual use and can be readily incorporated into coating machines and the like at low cost.

In accomplishing these and other objects according to one preferred embodiment of the present invention, there is provided an improved device for automatically controlling coating amount for use in a coating machine including a backup roll, an applicator roll, a pickup roll for picking up paint stored in a pickup pan, a base, a first table slidably mounted on said base, and a second table slidably mounted on said first table such that said applicator roll and said pickup roll are, respectively, secured to said first table and said second table, said device comprising: a first pressure adjusting mechanism for adjusting a contact pressure between said backup roll and said applicator roll such that said applicator roll is brought into pressing contact with said backup roll at a first preset value representing a first preset contact therebetween; and a second pressure adjusting mechanism for adjusting contact pressure between said applicator roll and said pickup roll such that said pickup roll is brought into pressing contact with said applicator roll at a second preset value representing a second preset

contact pressure therebetween; said first pressure adjusting mechanism further comprising: a first sensor for detecting a signal representing a contact pressure produced between said applicator roll and said backup roll; a first stepping motor arranged to be driven for rotation thereof in accordance with a difference between the signal detected by said first sensor and the first preset value; and a first precision ball bearing screw members for moving said first table relative to said base upon the rotation of said first stepping motor such that said applicator roll is moved toward or away from said backup roll; said second pressure adjusting mechanism further comprising: a second sensor for detecting a signal representing a contact pressure produced between said pickup roll and said applicator roll; a second stepping motor arranged to be driven for rotation thereof in accordance with a difference between the signal detected by said second sensor and the second preset value; and a second precision ball bearing screw member for moving said second table relative to said first table upon the rotation of said second stepping motor such that said pickup roll is moved toward or away from said applicator roll.

In accordance with the present invention, once the contact pressures have been set, it becomes possible to automatically adjust thickness of the coating film on the workpiece accurately by the use of the stepping motors and the precision ball bearing screw members both capable of performing forward or reverse movement through microns even if swell of the rolls takes place, and to precisely control the thickness of the coating film without shocks by varying the step advancing (or retracting) speed according to the program in case of temporary release of a seam of the workpiece to be coated.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other objects and features of the present invention will become apparent from the following description taken in conjunction with the preferred embodiment thereof with reference to the accompanying drawings, in which:

FIG. 1 is a front elevational view of a prior art coating machine (already referred to);

FIG. 2 is a partially sectional view of a pressure adjusting mechanism employed in the prior art coating machine of FIG. 1 (already referred to);

FIG. 3 is a front elevational view of a coating machine in which a device for automatically controlling coating amount according to the present invention is incorporated;

FIG. 4 is a schematic view of the coating machine of FIG. 3;

FIG. 5 is a control circuit diagram of the device of FIG. 3; and

FIG. 6 is a view similar to FIG. 4, particularly showing a modification thereof.

Before the description of the present invention proceeds, it is to be noted that like parts are designated by like reference numerals throughout several views of the accompanying drawings.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to the drawings, there is shown in FIGS. 3 and 4, a coating machine S in which a device K for automatically controlling coating amount according to the present invention is incorporated. The coating machine S generally includes a backup roll **51**, an applicator roll **52** made of elastic material such as rubber, a pickup roll **55** for picking up paint stored in a pickup pan **57**, a metering roll **58**, a base **53**, a first table **54** slidably mounted on the base **53**, a second table **56** slidably mounted on the first table **54**, and a third table **59** slidably mounted on the second table **56** such that the applicator roll **52**, the pickup roll **55** and the metering roll **58** are, respectively, secured to the first table **54**, the second table **56** and the third table **59**, with a sheet-like workpiece **60** subjected to coating being passed between the backup roll **51** and the applicator roll **52**. It is to be noted that such an arrangement of the coating machine S is already known and each of the backup roll **51**, the applicator roll **52**, the pickup roll **55** and the metering roll **58** is driven by a hydraulic motor or a DC (or AC) motor (not shown).

Meanwhile, the device K of the present invention includes a first pressure adjusting mechanism **61** for adjusting a contact pressure between the backup roll **51** and the applicator roll **52**, a second pressure adjusting mechanism **65** for adjusting contact pressure between the applicator roll **52** and the pickup roll **55** and a control board to be described later. The first clearance pressure mechanism **61** is arranged to move the first table **54** relative to the base **53** such that the applicator roll **52** is brought into pressing contact with the backup roll **51**. Likewise, the second pressure adjusting mechanism **65** is arranged to move the second table **56** relative to the first table **54** such that the pickup roll **55** is brought into pressing contact with the applicator roll **52**. More specifically, the first pressure adjusting mechanism **61** includes a stepping motor **62**, a sensor **63** and a precision ball bearing screw member **64**. The sensor **63** may be of any known contact pressure type. The stepping motor **62** and the contact pressure sensor **63** coupled to the stepping motor **62** are mounted on the base **53**, while the precision ball bearing screw member **64** is mounted on the first table **54** so as to be coupled to the stepping motor **62** through the sensor **63**. It is so arranged that the first table **54** is moved relative to the base **53** by the precision ball screw member **64** upon rotation of the stepping motor **62** such that the applicator roll **52** is moved toward or away from the backup roll **51**. The sensor **63** and the precision ball bearing screw member **64** are operatively associated with the control board and can be exchanged, in position, with each other as shown in FIGS. **4** and **6**. In the same manner as the first pressure adjusting mechanism **61**, the second pressure adjusting mechanism **65** includes a stepping motor **62'**, a contact pressure **63'** and a precision ball bearing screw member **64'**. The stepping motor **62'** and the sensor **63'** coupled to the stepping motor **62'** are mounted on the first table **54**, while the precision ball bearing screw member **64'** is mounted on the second table **56** so as to be coupled to the stepping motor **62'** through the sensor **63'**. It is so arranged that the second table **56** is moved relative to the first table **54** by the precision ball screw **64'** upon rotation of the stepping motor **62'** such that the pickup roll **55** is moved toward or away from the applicator roll **52**. The sensor **63'** and the precision ball bearing screw member **64'** are operatively associated with the control board and can be exchanged, in position, with each other as shown in FIGS. **4** and **6**.

The device K further includes a third pressure adjusting mechanism **76** for adjusting a third pressure between the pickup roll **55** and the metering roll **58**. The third

pressure adjusting mechanism 76 is arranged to move the third table 59 relative to the second table 56 such that the metering roll 58 is brought into a pressure relative the pickup roll 55. The third pressure adjusting mechanism 76 includes a stepping motor 66, a precision ball bearing screw member 67 and a sensor 68, for instance, a roll clearance sensor. The stepping motor 66 and the sensor 68 composed of, for example, a pulse encoder coupled to the stepping motor 66 are mounted on the second table 56, while the precision ball bearing screw member 67 is mounted on the third table 59 so as to be coupled to the sensor 68 through the stepping motor 66. The stepping motor 66 and the sensor 68 can be exchanged, in position, with each other as shown in FIGS. 4 and 6. It is so arranged that the third table 59 is moved relative to the second table 56 by the precision ball bearing screw member 67 upon the rotation of the stepping motor 66 such that the metering roll 58 is moved toward or away from the pickup roll 55. The clearance between the two controls the coating thickness being applied to material 60. It is to be noted that the precision ball bearing screw members 64, 64' and 67 are arranged to directly move, upon rotation thereof, the first, second and third tables 54, 56 and 59, respectively and, for example, NSK precision ball bearing screw members (name used in trade and manufactured by Nippon Seiko K.K., Japan) can be employed therefor.

Meanwhile, as shown in FIG. 5, the control board includes a pair of control circuits C connected to the first pressure adjusting mechanism 61 and the second pressure adjusting mechanism 65, respectively. Namely, when a preset contact pressure to be applied from the applicator roll 52, through the workpiece 60, to the backup roll 51 has been given to a presetter 69 as a preset signal in the first pressure adjusting mechanism 61, a contact pressure applied from the applicator roll 52 to the backup roll 51 is detected as a reaction force of elastic material of the applicator roll 52 and thus, a contact pressure between the applicator roll 52 and the backup roll 51 is detected through the precision ball bearing screw member 64 by the sensor 63. This detection signal of the sensor 63 is transmitted via an amplifier 70 for the sensor 63 so as to be compared with the preset signal from the presetter 69 and then, is applied to a comparator circuit 72 by way of a preamplifier 71. In the case where a difference between the detection signal of the sensor 63 and the preset signal from the presetter 69 exceeds a predetermined value, a comparator signal is delivered from the comparator circuit 72 and then, the gate circuit 73 is opened, so that a pulse signal is inputted to a driver unit 75 on the basis of a frequency of an oscillator 74 connected to the gate circuit 73, the frequency being varied by a preset program. Thus, the stepping motor 62 is rotated forwardly or reversely at a given programmed speed through a predetermined angle by a power signal from the drive unit 75. Upon the rotation of the stepping motor 62, the first table 54 is moved relative to the base 53 by the precision ball bearing screw member 64 such that the applicator roll 52 is moved toward or away from the backup roll 51. Subsequently, a signal indicating a change in contact pressure between the backup roll 51 and the applicator roll 52 due to movement of the applicator roll 52 toward or away from the backup roll 51 is again fed back to the control circuit C such that the applicator roll 52 is brought into pressing contact with the backup roll 51 automatically at a preset value based on the contact pressure. Consequently, the backup roll 51 and the applicator roll 52 are maintained at the preset contact pressure therebetween.

Furthermore, if a change in a roll diameter due to replacement of the applicator roll 52, etc. causes difference in the amount of movement between the tables, the pressure between the rolls, when the sensor 63 detects the given contact pressure, is automatically memorized and is designated as an original point of the pressure. Thus, the relation in respect of coating conditions is always kept if the movement is repeated.

Adjustments between the applicator roll 52 and the pickup roll 55 and between the pickup roll 55 and the metering roll 58 are performed in the same manner as described above.

In the event that the coating operation of the coating machine S is started or stopped by moving the first table 54 or that a seam of the workpiece 60 to be coated is temporarily advanced or retracted for cleaning, the roll (contact pressure) between the applicator roll 52 and the backup roll 51 is adjusted by the first pressure adjusting mechanism 61 by moving the first table 54 at said programmed speed.

The second table 56 and the third table 59 are also moved in the same manner as the above described first table 54.

As is clear from the foregoing description, in accordance with the present invention, the contact pressure applied from the applicator roll to the backup roll, the contact pressure applied from the pickup roll to the applicator roll and the pressure between metering roll and the pickup roll is detected by the appropriate sensors. Thereafter, this is compared with the preset value such that the precision ball bearing screw member is driven through the stepping motor, so that the first table and/or the second table is moved relative to the base and/or the first table, whereby the coating amount on the workpiece is automatically controlled precisely.

Furthermore, in accordance with the present invention, since each of the first table and the second table is moved automatically by the use of the stepping motor and the precision ball bearing screw both free from play, it becomes possible to accurately control the thickness of the coating film on the workpiece.

Although the present invention has been fully described by way of example with reference to the accompanying drawings, it is to be noted here that various changes and modifications will be apparent to those skilled in the art. Therefore, unless otherwise such changes and modifications depart from the scope of the present invention, they should be construed as included therein.

What is claimed is:

1. A device for automatically controlling the coating amount of paint deposited on a continuous strip moving between a pair of circular rolls in a coating machine including at least three tandemly located circular rolls that are in continuous adjustable contact with the next adjacent roll in the tandem sequence, said rolls including a circular backup roll and a circular applicator roll of an elastic material with a strip to be coated moveable therebetween, a circular pickup roll in contact with said elastic applicator roll for picking up paint stored in a pickup pan, and a circular metering roll in contact with the circular pickup roll, a fixed base, a first table slidably mounted on said base, and a second table slidably mounted on said first table such that said circular applicator roll and said circular pickup roll are, respectively,

slidably secured to said first and said second table for a continuous and automatically adjustable pressure contact between all of said circular rolls, said device comprising:

a present pressure control program for automatically and continuously controlling the pressure adjustment between adjacent individual ones of said above-claimed circular rolls to lie within an equilibrium condition within a predetermined range of pressure;

means for emitting a first preset signal indicative of a desired preset contact pressure range between said circular backup roll and said circular elastic applicator roll while said strip to be coated is moved therebetween;

a first pressure adjusting mechanism coupled between said fixed base and said first table for continuously and automatically adjusting the contact pressure applied from said applicator roll through said backup roll such that said applicator roll is slidably brought into pressing elastic contact with said backup roll at a pressure lying within said predetermined equilibrium pressure range;

means for emitting a second preset signal indicative of a range of desired preset contact pressure between said applicator roll and said pickup roll;

a second pressure adjusting mechanism carried by said first table and coupled between said first and second tables for continuously and automatically adjusting the pressure between said applicator roll and said pickup roll such that said pickup roll is slidably brought in pressing contact with said applicator roll at a pressure lying within said second pressure range therebetween;

said first pressure adjusting mechanism further comprising;

a first sensor in combination with a first precision ball bearing screw member for detecting a first signal representing a contact pressure reaction force of said elastic applicator roll material produced between said applicator roll and said backup roll;

a first comparator circuit means for generating and storing said first detected signal, and means associated with said first comparator circuit for emitting a first difference signal indicative of the difference, if any, between said first preset value range and said first sensor's detected signal value;

a first stepping motor arranged to be intermittently driven through step angle rotation thereof by said first difference signal when said first sensed signal is outside said predetermined range and in accordance with said preset pressure control program;

said first precision ball bearing screw member being further adapted for moving said first table relative to said base upon the intermittent rotation of said first stepping motor such that said applicator roll is slideably moved by steps toward or away from said backup roll at a speed controlled by said preset pressure control program until said desired and controlled preset pressure is achieved within said predetermined range and the reaction force sensed by said first sensor is at a null condition that stops further rotation of said first stepping motor;

said second pressure adjusting mechanism further comprising;

a second sensor in combination with a second precision ball bearing screw member detecting a second signal representing a contact pressure reaction force of said elastic applicator roll material produced between said pickup roll and said elastic applicator roll;

a second comparison circuit means for generating and storing said second sensor's detected signal, and means associated with said second comparator circuit for emitting a second difference signal indicative of the difference, if any, between said second preset value range and said second sensor's detected value;

a second stepping motor arranged to be intermittently driven through step angle rotation thereof in accordance with said second difference signal when said second signal is outside said second predetermined range and in accordance with said preset pressure control program; and

said second precision ball bearing screw member being further adapted for moving said second table relative to said first table upon the intermittent rotation of said second stepping motor such that said pickup roll is slidably moved by steps toward or away from said applicator roll at a speed controlled by said preset pressure control program until said second desired and controlled preset pressure is achieved and said reaction force sensed by said second sensor is at a null condition that stops further rotation of said second stepping motor.

2. A device as claimed in claim 1, further including a third table slidably mounted on said second table such that said metering roll is secured to said third table.

3. A device as claimed in claim 1, wherein each of said first pressure adjusting mechanism and said second pressure adjusting mechanism further comprises a presetter for defining each of the first preset contact pressure and the second preset contact pressure, and wherein said first and second comparators include a series connected circuit having a coincidence gate and a driver unit, together with an oscillator adapted to feed driving pulses through said gate and driver unit to said stepping motor circuit when said gate circuit is in an enabled condition.

4. A device for automatically controlling coating amount for use in a coating machine including a circular backup roll mounted for rotation on a backup axle, and an elastic circular applicator roll mounted for rotation on an applicator axle, a circular pickup roll mounted for rotation on a pickup axle for picking up paint stored in a pickup pan, a base, a first table slidably mounted to move said applicator roll and its axle on said base, and a second table slidably mounted on said first table to move said pick up roll and its axle along with said second table such that said elastic applicator roll and said pickup roll are, respectively, secured to and move with said first table and with said second table, respectively, said device comprising:

a first contact adjusting mechanism for automatically and continuously adjusting a contact pressure between said backup roll and said elastic applicator roll by moving the first table, the applicator roll and its axle such that said elastic applicator roll is automatically brought into pressing contact with said backup roll at a first preset value representing a first preset contact pressure therebetween; and

a second contact adjusting and continuously mechanism moveable both on said first contact adjusting mechanism and also automatically adjustable independently from said first adjusting mechanism, for

automatically adjusting a contact pressure between said elastic applicator roll and said pickup roll by moving the pickup roll and its axle such that said pickup roll is brought into pressing contact with said applicator roll at a second preset value representing a second preset contact pressure until said elastic applicator roll is in a continuous equilibrium state between said backup and said elastic pickup rolls in the presence of swells in said rolls or a seam in said workpiece being coated while said automatic adjustment is taking place.

5. A device in accordance with claim 4 wherein said first contact adjusting mechanism further comprises:

a first sensor for detecting a first signal representing a contact pressure produced between said elastic applicator roll and said backup roll; and

a first stepping motor arranged to be driven for rotation in accordance with said difference signal between the first signal detected by said first sensor and the first preset value.

6. A device in accordance with claim 5 and further comprising:

a first precision ball screw for moving said first table relative to said base upon the rotation of said first stepping motor such that said elastic applicator roll is moved toward or away from said backup roll.

7. A device in accordance with claim 6 wherein said second contact adjusting mechanism further comprises:

a second sensor for detecting a second signal representing a contact pressure produced between said pickup roll and said elastic applicator rolls; and

a second stepping motor arranged to be driven for rotation in accordance with said difference signal between the second signal detected by said second sensor and the second preset value.

8. A device in accordance with claim 7 and further comprising:

a second precision ball bearing screw member for moving said second table relative to said first table upon the rotation of said second stepping motor such that said pickup roll is moved toward or away from said elastic applicator roll.

9. A device as claimed in claim 4 and further including:

a metering roll; and

a third table slidably mounted on said second table such that said metering roll is secured to said third table and is adjustable toward or away from said pickup roll.

10. A device as claimed in claim 9, and further comprising a third pressure adjusting mechanism, said third pressure adjusting mechanism comprising:

a third sensor for detecting a signal representing contact pressure produced between said metering roll and said pickup roll; and

a third stepping motor arranged to be driven for rotation thereof in accordance with a difference between the signal detected by said third sensor and the third preset value.

11. A device in accordance with claim 10 and further comprising:

a third precision ball bearing screw member for moving said third table relative to said second table upon the rotation of said third stepping motor such that said metering roll is moved toward or away from said pickup roll.

12. A device as claimed in claim 11 wherein each of said first and second pressure adjusting mechanisms each further comprises:

a presetter for defining each of the first preset contact pressure and the second preset contact pressure; and

wherein said first and second comparators each include a series-connected circuit having a coincidence gate and a driver unit, with an oscillator adapted to feed driving pulses through said coincidence gate and the driver unit to each of said stepping motor circuits when said coincidence gate circuit is in an enabled condition.

13. In a control device for automatically controlling the amount of paint applied to an elongated sheet having a backup roll supporting the sheet which contains an enlarged seam therein, an applicator roll for applying the paint, a pickup roll for picking up the paint stored in a pickup pan, a support base, a first table slidably mounted on said base, and a second table slidably mounted on said first table such that said applicator roll and said pickup roll are, respectively, secured to said first table and said second table, the improvement comprising:

an elasticized coating on said applicator roll with said elasticized applicator roll being positioned in tandem with said other rolls and located between said pickup and said backup rolls;

a first contact adjusting mechanism for adjusting a contact pressure between said backup roll and said elasticized applicator roll such that said applicator roll is brought into pressing contact with said backup roll at a first preset value representing a first preset contact pressure therebetween;

a second contact adjusting mechanism for adjusting a contact pressure between said elasticized applicator roll land said pickup roll such that said pickup roll is brought into pressing contact with said applicator roll at a second preset value representing a second preset contact pressure therebetween;

means for storing and generating electrical signals representative of said first and second preset contact pressure values;

said first contact adjusting mechanism further consisting of a first sensor means for producing a first signal representing the actual contact pressure between said elasticized applicator roll and said backup roll, and a first stepping motor arranged to be electrically driven for rotation thereof in accordance with a difference signal between the actual contact pressure signal detected by said first sensor and the first preset value;

a first precision member for automatically moving both said first table and said second contact adjusting mechanism relative to said base in response to said first difference signal by rotation of said first stepping motor such that said elasticized applicator roll is moved toward or away from said backup roll;

said second contact adjusting mechanism further consisting of;

a second sensor means for producing a second signal representing a contact pressure produced between said pickup roll and said elasticized applicator roll;

a second stepping motor arranged to be electrically driven for rotation thereof in accordance with a difference between the second signal detected by said second sensor and the second preset value; and

a second precision member for automatically moving said second table relative to said first table upon the rotation of said second stepping motor such that said pickup roll is moved toward or away from said elasticized applicator roll, said adjustments of the respective first and second contact adjusting mechanisms independently and automatically being implemented continuously to place all of said tandem rolls in an equilibrium state that assures a constant amount of paint being applied to the sheet in the presence of said seam in another sheet, which seam disrupts the pressure between said tandem rolls were it not for the continuous adjustment of said first and second contact adjustment mechanisms.

* * * * *

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United States Patent [19]

Sarda

[11] **Patent Number: 4,889,051**

[45] **Date of Patent: Dec. 26, 1989**

[54] **REMOVABLE INKING DEVICE FOR OFFSET PRESS**

[76] Inventor: **Jean-Claude Sarda**, 48 Avenue Claude Vellefaux, Paris, France, 75010

[21] Appl. No.: **224,071**

[22] Filed: **Jul. 25, 1988**

[30] **Foreign Application Priority Data**

Aug. 3, 1987 [FR] France 87 10972

[51] **Int. Cl.**[4] **B41F 7/06**; B41F 7/10; B41F 13/40

[52] **U.S. Cl.** **101/77**; 101/137; 101/177; 101/247

[58] **Field of Search** 101/177, 181, 182, 185, 101/184, 136, 137, 139, 140, 142, 143, 144, 145, 76, 77, 91, 247

[56] **References Cited**

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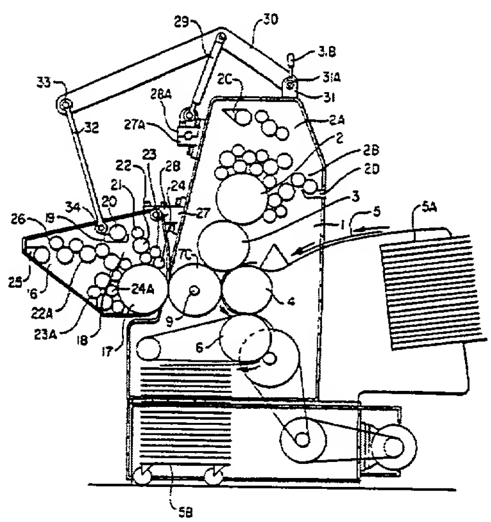
Primary Examiner—J. Reed Fisher

[57] **ABSTRACT**

A detachable printing unit for offset printing presses, which can be incorporated during their manufacture or fitted to existing presses, said unit being defined in that it is composed of an independent inking module **16** (FIG. 3) comprising all the components required for effecting in chronological operating order the moistening and inking of an offset plate ready for printing on a blanket, and a likewise independent detachable blanket cylinder 7C. One embodiment of the invention is defined in that the numbering device with which the press is equipped (FIG. **6**, View B) is replaced by the blanket cylinder (FIG. **7**, View B) of the printing unit working with the inking module **16** (FIG. **3**), and use is made of the drive mechanism **8** (FIG. **6**) and pressure adjustment mechanism **9B** provided in the press to obtain for each printing cycle, instead of the numbering, an additional color obtained by color superimposition with the aid of the pressure cylinder **4**. In the other form of the invention the same inking module, disposed in another position in the press, works conjointly with the blanket cylinder **3** of the press to enable for each printing cycle an additional color and optionally letterpress numbering or an additional letterpress color to be achieved.

6 Claims, 10 Drawing Sheets



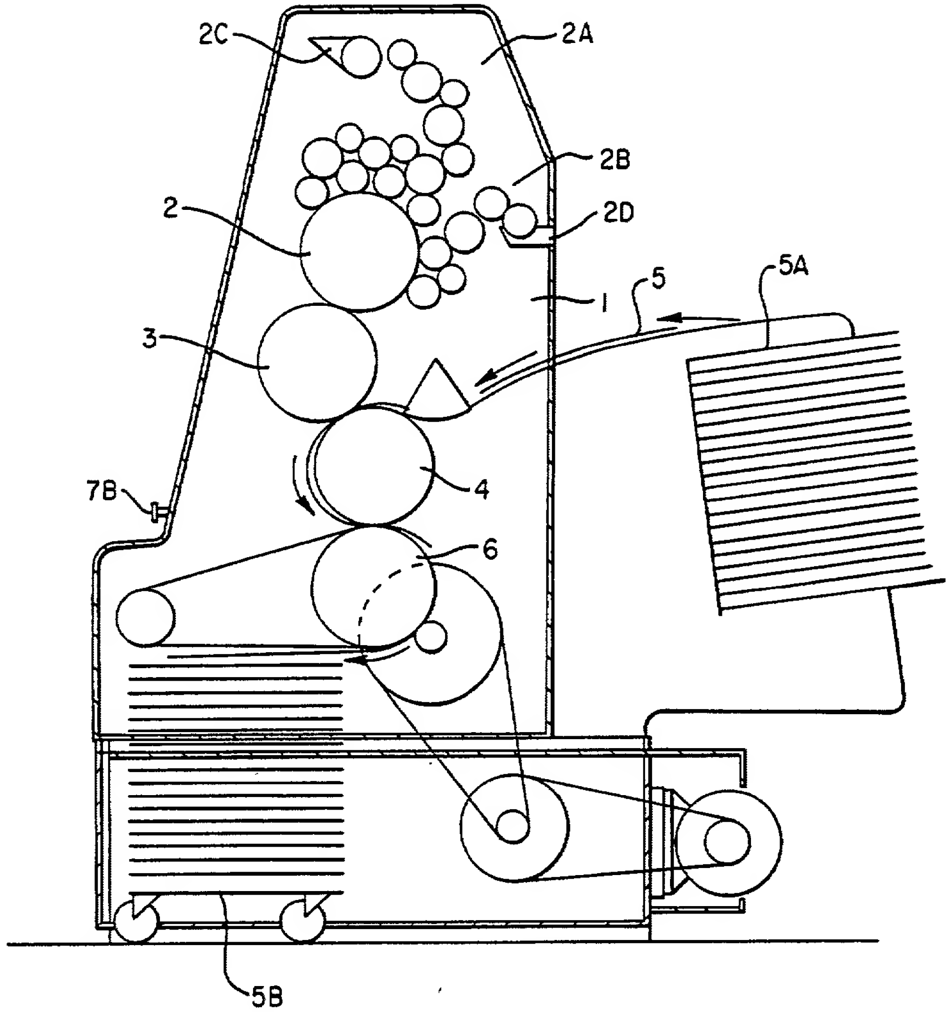


FIG. 1
PRIOR ART

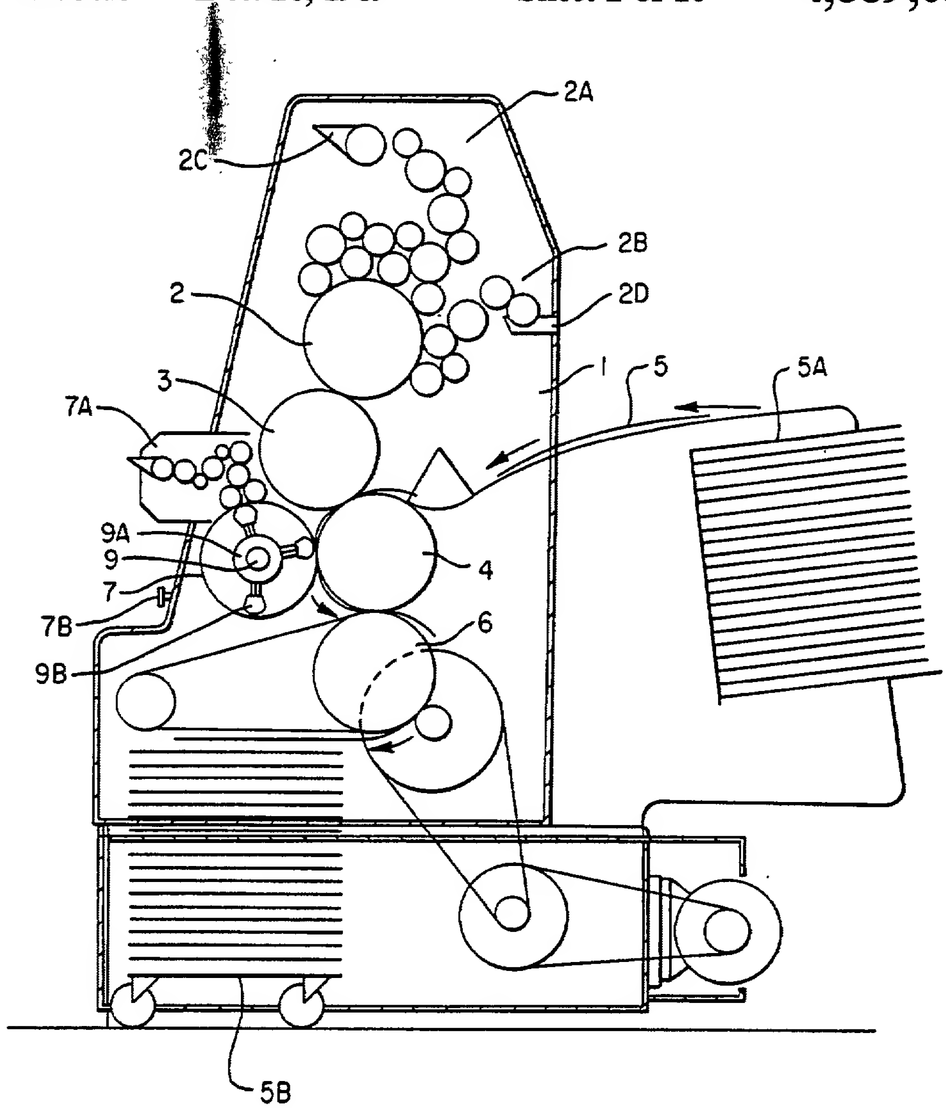


FIG. 2
PRIOR ART

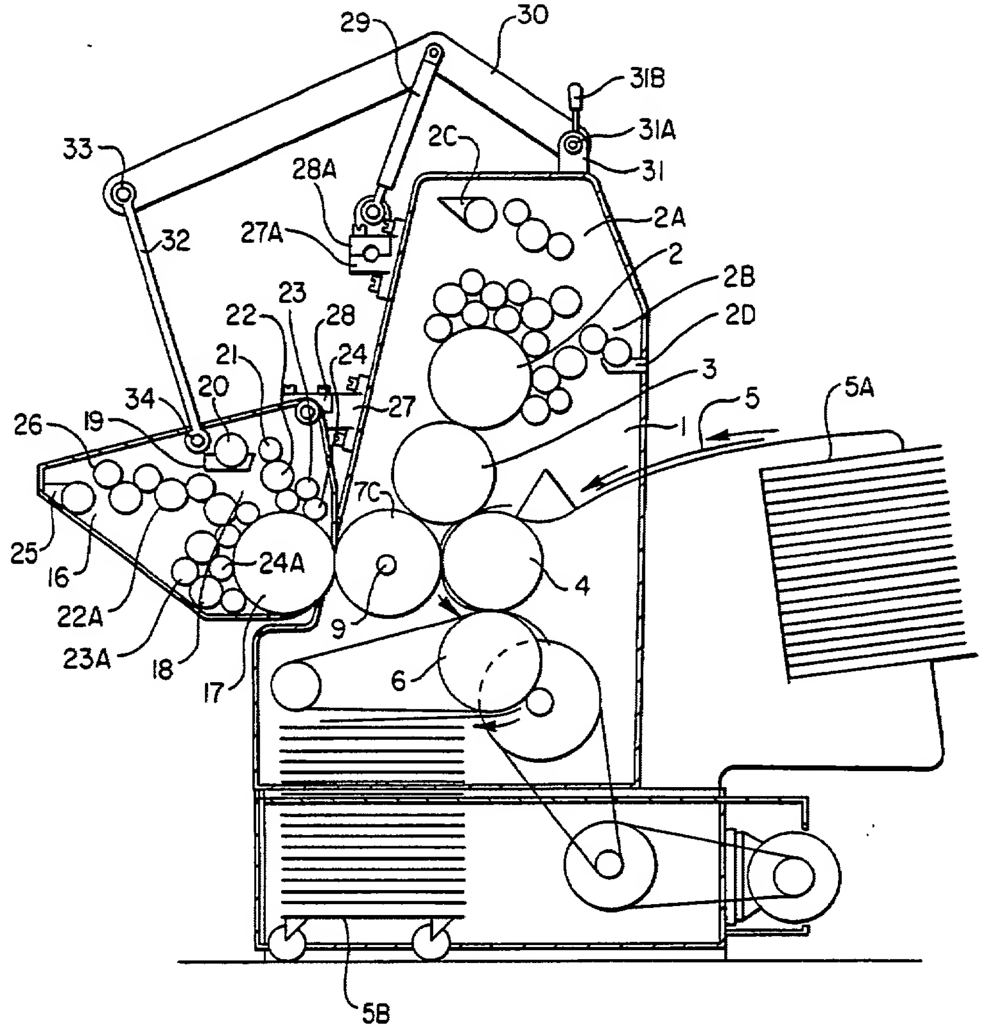

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FIG. 3

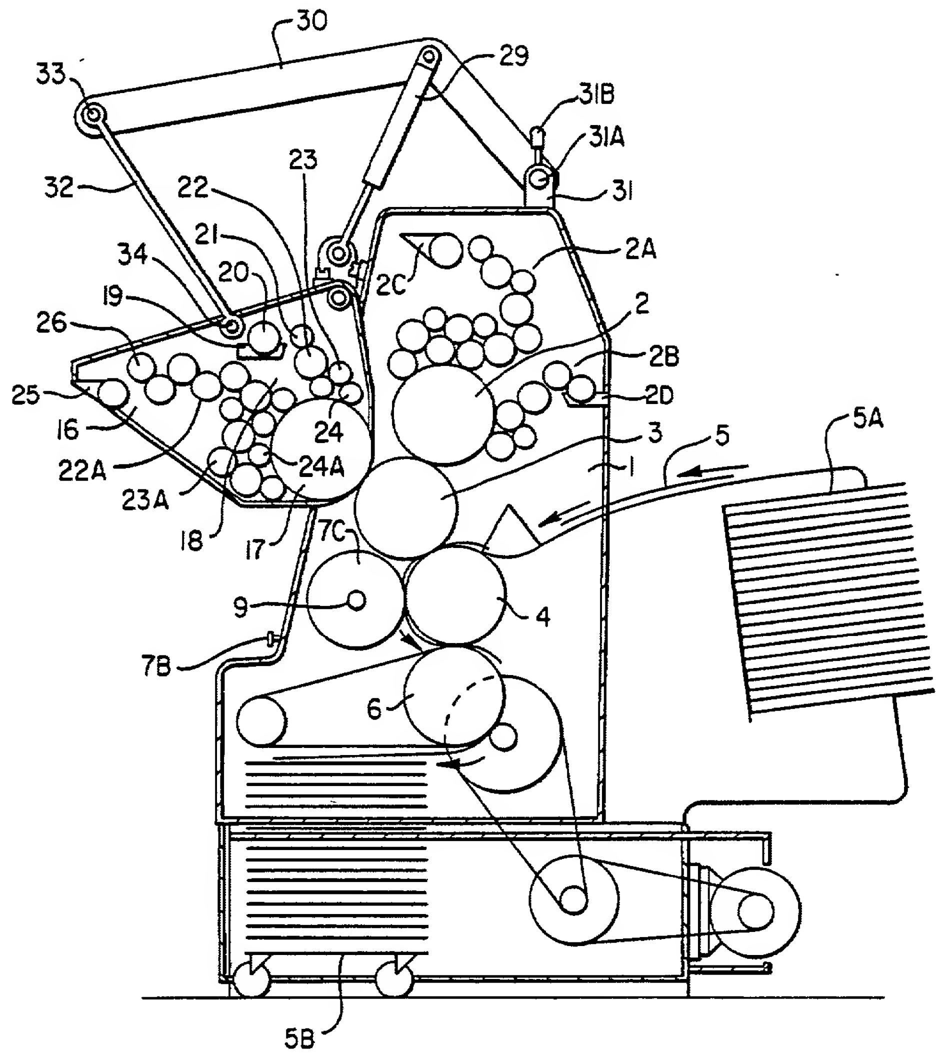

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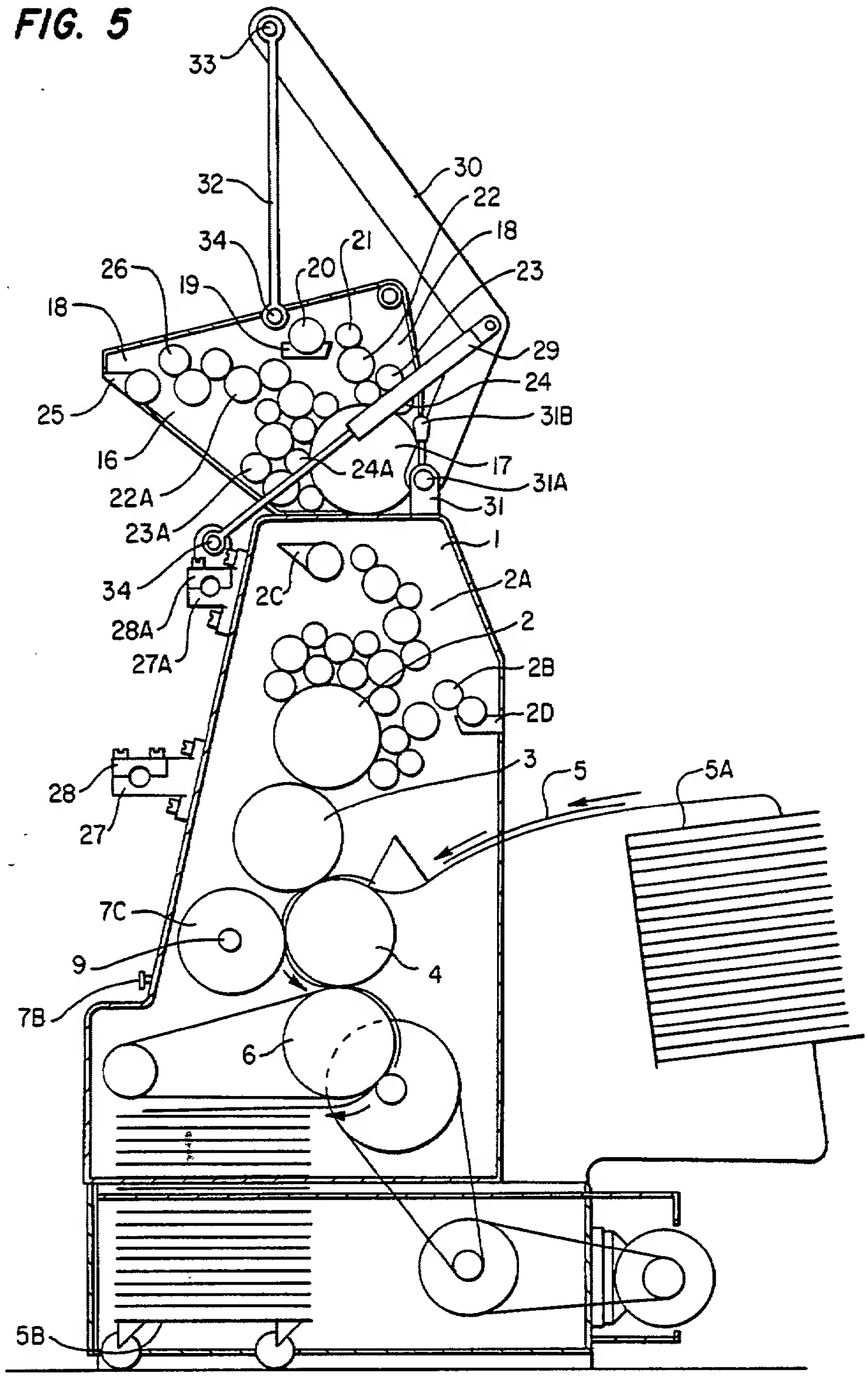
FIG. 4

FIG. 5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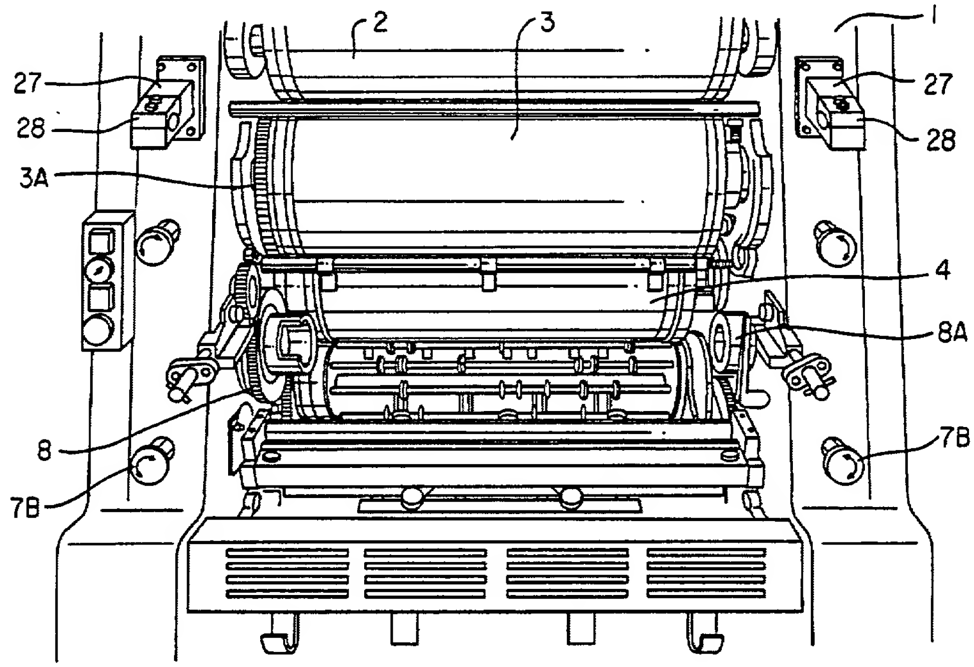


FIG. 6A
PRIOR ART

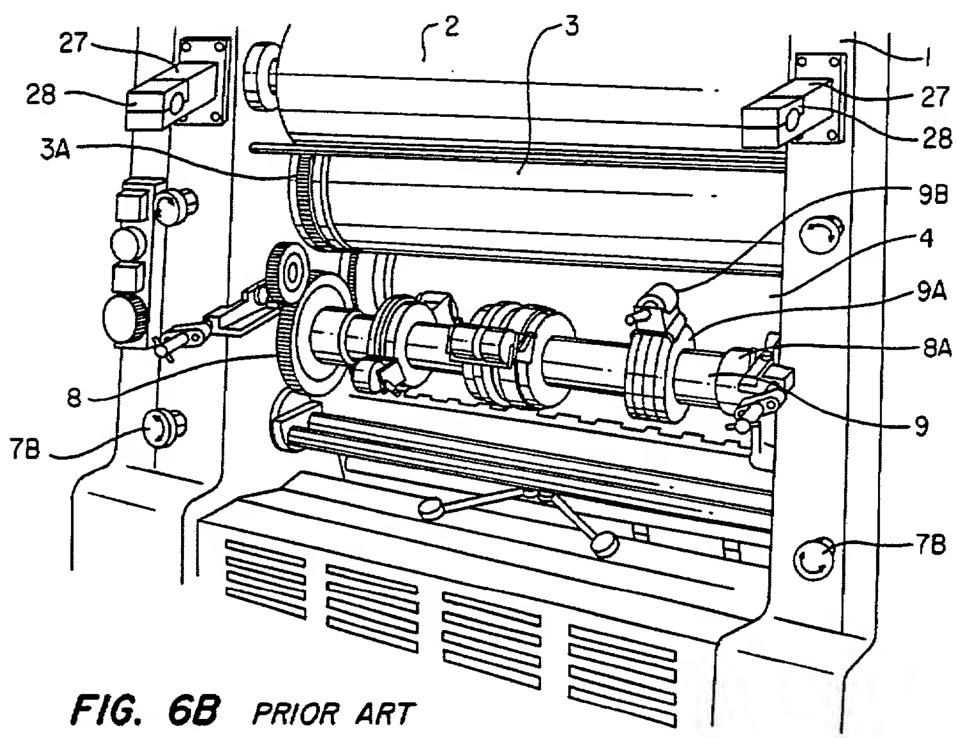


FIG. 6B PRIOR ART

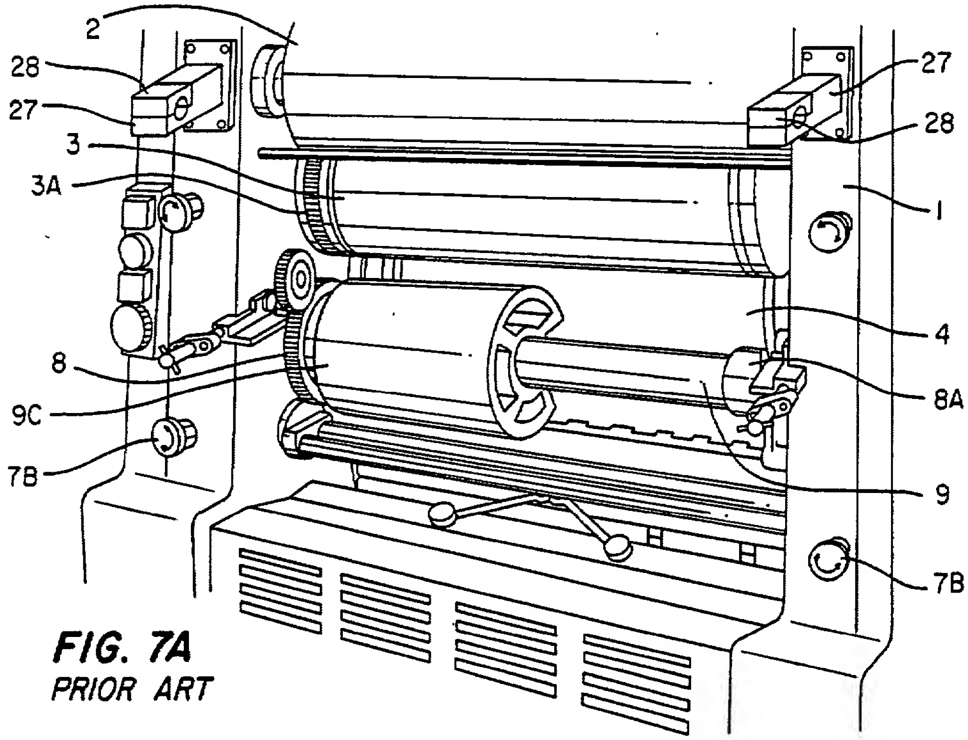


FIG. 7A
PRIOR ART

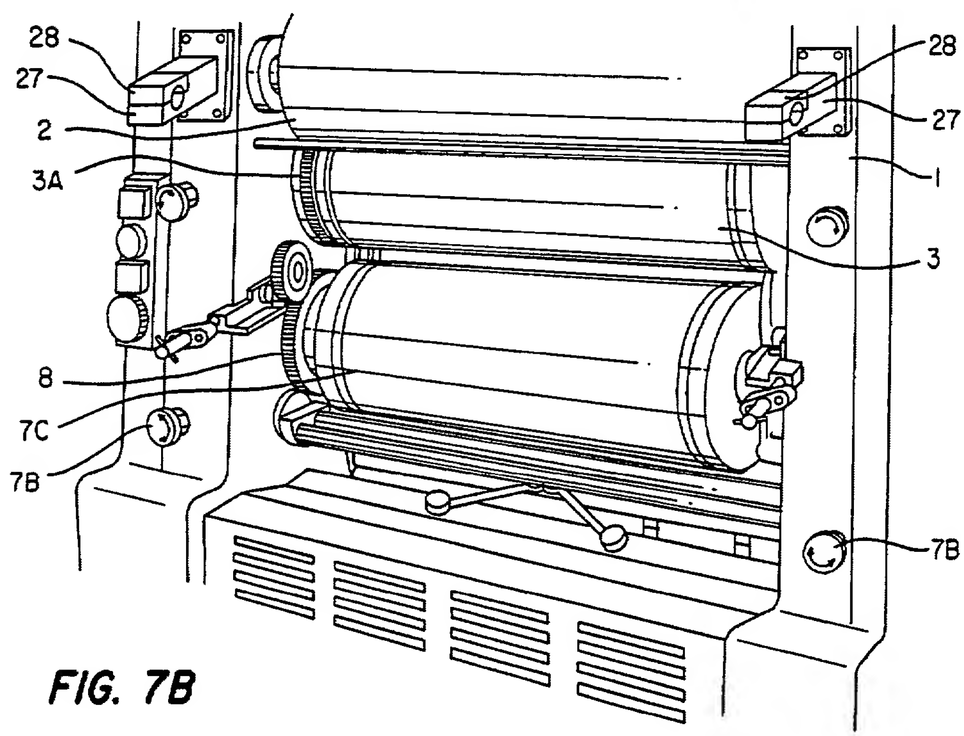


FIG. 7B

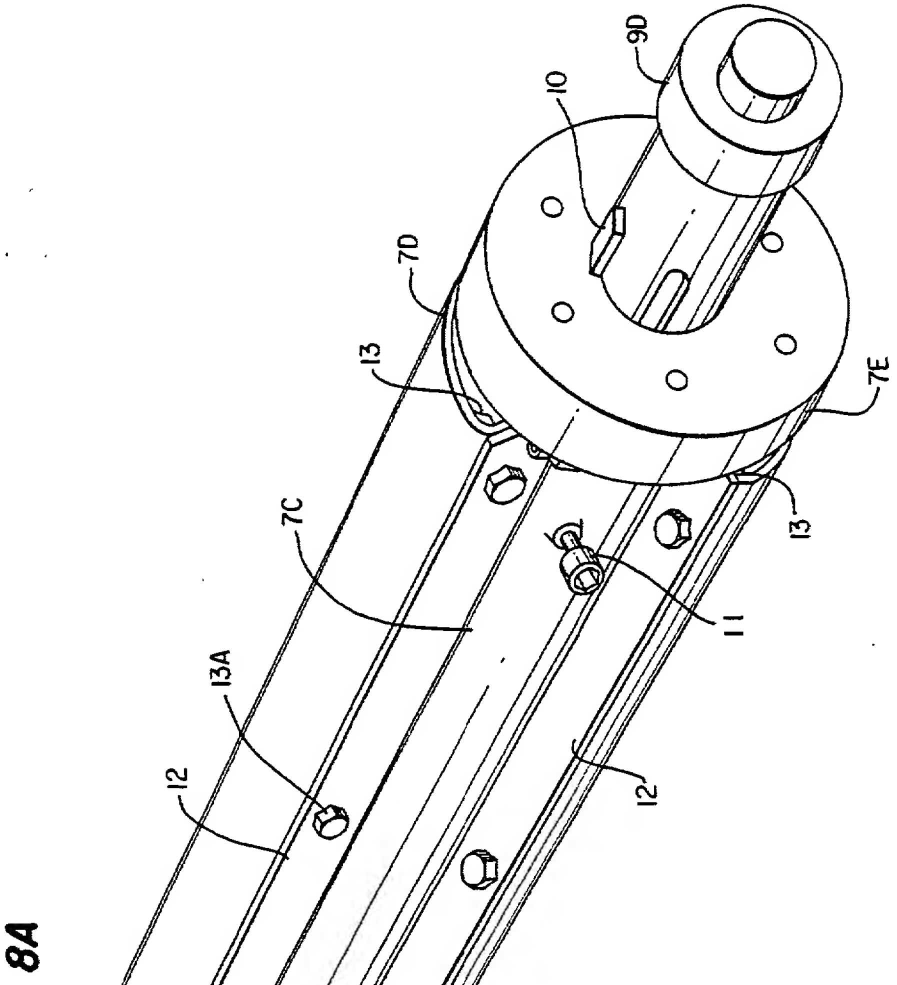


FIG. 8A

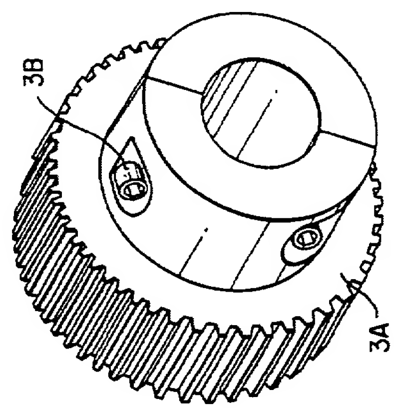
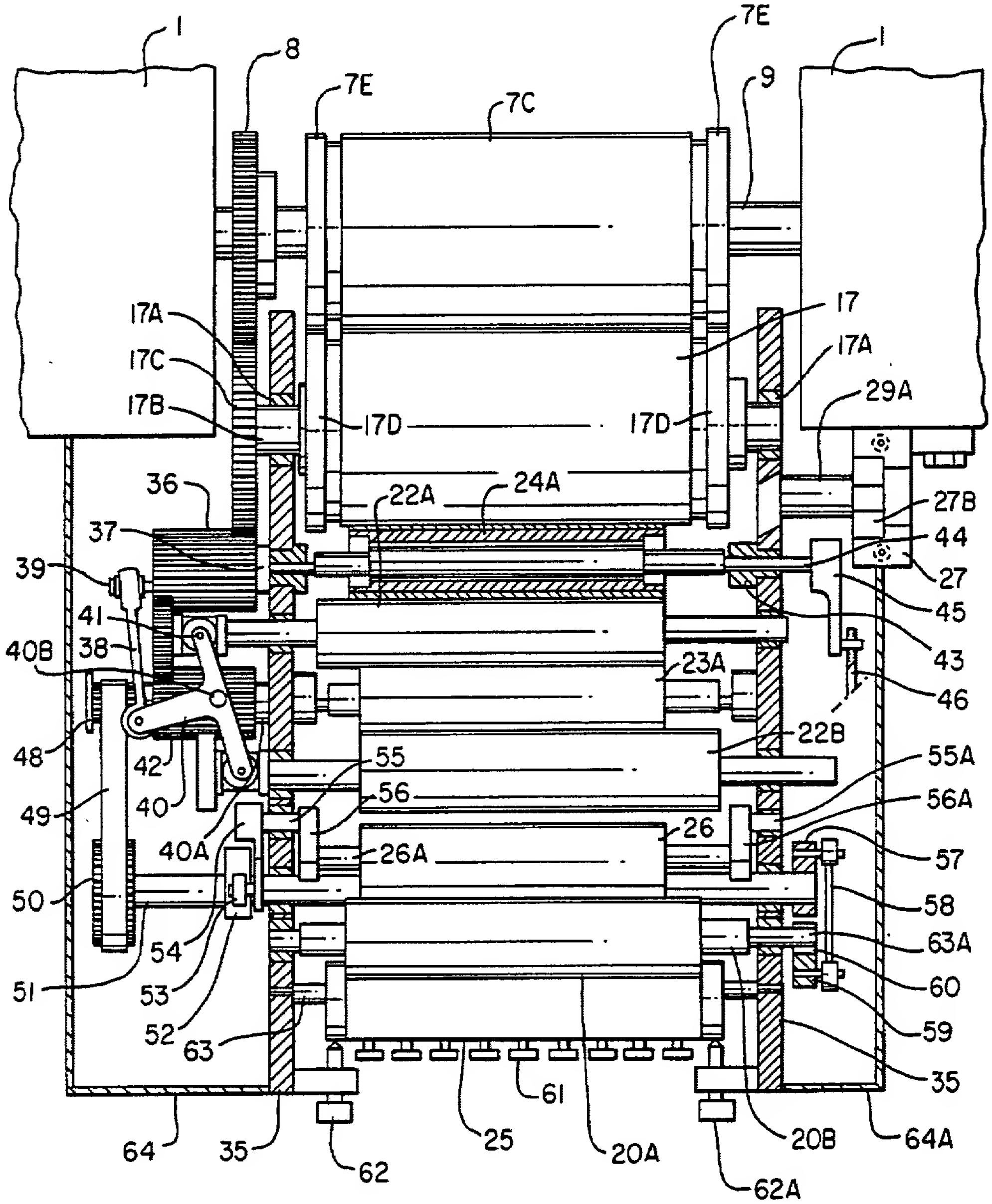


FIG. 8B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57
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58
54
63A
51
53
60
52
59
63
35
61
64
35
25
20A
20B
64A
62
62A

FIG. 9

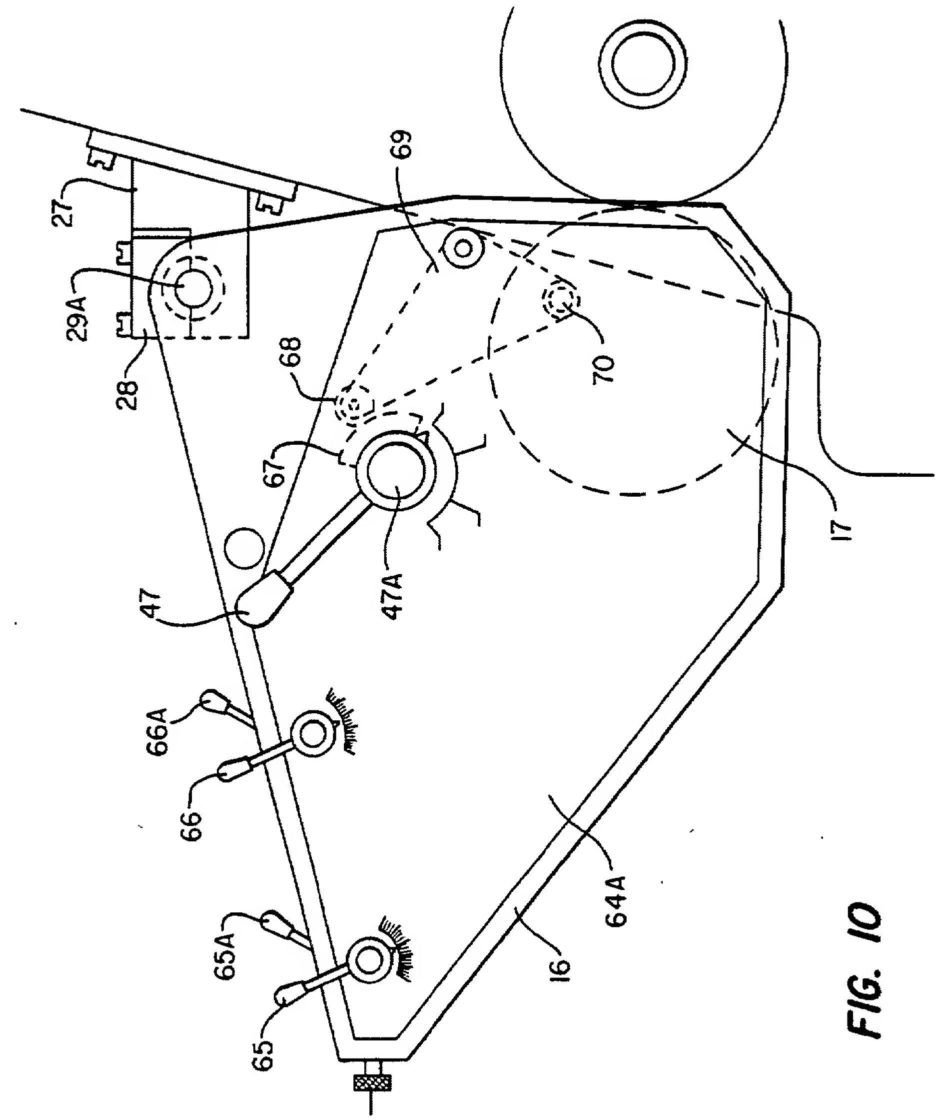

FIG. 10

REMOVABLE INKING DEVICE FOR OFFSET PRESS

FIELD OF THE INVENTION

The present invention relates to a detachable printing unit adapted to be fitted to existing offset printing presses or to be incorporated in such presses during their manufacture.

BACKGROUND OF THE INVENTION

This printing unit consists of an inking module and a blanket cylinder, which are independent of one another, in such a manner as to enable the inking module to be used alone or conjointly with the blanket cylinder.

In one form the invention is defined in that the numbering device with which the press is equipped is replaced by the blanket cylinder of the printing unit working with the inking module, and use is made of the drive mechanism and pressure adjustment mechanism provided in the press to obtain for each printing cycle, instead of the numbering, an additional color obtained by color superimposition.

In the other form of the invention the same inking module, disposed in another position in the press, works conjointly with the blanket cylinder of the press to enable for each printing cycle an additional color and optionally numbering to be achieved.

SUMMARY OF THE INVENTION

At the present time the great majority of professional offset printing presses are designed to print three or four colors. Their mode of operation differs little from one manufacturer to another, and the choice made by the printer is guided by the reliability of the presses, the simplicity of starting them up and operating them, and their production possibilities.

The operating principle of a traditional GTO Heidelberg press, which is representative of this type of machine and for that reason has been chosen to illustrate the invention, is descried schematically below by way of indication and with reference to the accompanying drawings.

The press shown in FIG. 1 consists of a frame 1 containing all the elements of which the press is composed. The inking unit 2A and its dampener 2B (inking rollers shown solid and dampening rollers hatched) moisten and ink the offset plate fixed on the plate cylinder 2. The inked plate prints its image on the blanket of the blanket cylinder 3. The paper 5 coming from the stack 5A is printed by transfer as it passes between the blanket cylinder 3 and the pressure cylinder 4. The printed sheet is taken up by the grippers of the chain delivery device 6, and is then deposited on the delivery stack 5B. The ink duct 2C and the system effecting dampening from the water reservoir 2D are provided with means enabling the supply of ink and water to be metered in dependence on the ink load necessary for the type of printing to be done. The plate cylinder 2 is provided with means for attaching and aligning the offset plate and with adjustment facilities for moving it circumferentially relative to the blanket cylinder 3, so as to achieve good positioning of the impression on the stock to be printed. The blanket cylinder 3 is also provided with the mechanical elements necessary for the fixing and tensioning of the blanket. The pressure cylinder 4 is provided with grippers for holding the sheet during printing.

A detachable letterpress numbering and additional color device 7 (FIG. 2) is included in these presses and operates in the following manner:

The inking unit 7A inks the numberers 9B or the letterpress blocks, which deposit their impression directly on the sheet 5 which has just received its offset impression from the blanket of the blanket cylinder 3. This letterpress printing is effected in line in the same printing cycle as the offset printing and in perfect register with the latter, the drive means being synchronized and interconnected. The pressure necessary for this letterpress printing is obtained between the pressure cylinder 4 (as in offset printing) and the numberers or letterpress blocks. The adjustment screws 7B placed on each side of the press permit micrometer adjustment of the pressure of the shaft carrying the numberers or blocks. The chronological order determined for carrying out the different operations leading to the impression is arranged by various control levers designed for achieving this order. All these functions are synchronised for each printing cycle. These presses are provided with a very accurate sheet positioning mechanism enabling them to achieve perfect register of each color in the case of successive impressions on the same sheet. This type of professional presses is also made for two, four and five colors. These multicolor presses are formed by grouping together a number of basic one-color presses. The sheet passes in succession from one press to the other, use being made of mechanisms carrying it positively with the aid of grippers. In these presses the numbering device is disposed on the final printing press. Certain makers offer as an option an additional inking unit, usually detachable, for one offset color. These units are independent and are provided with all elements required for moistening and inking an offset plate fixed on a plate cylinder of the same diameter as that of the basic press, as well as the control mechanisms required for the chronological sequencing of all the functions. This inked plate prints its image on the blanket of the press, which consequently receives two inked images of different colors for each impression cycle. These two images are transferred simultaneously to the sheet passing between the blanket cylinder and the pressure cylinder of the press. These added units are in most cases not made by the large manufacturers of printing presses. One American manufacturer has specialized in this type of printing units adapted to be fitted to all kinds of presses, and many American and foreign printers use them successfully because these added units are very useful to printers, although they do not make it possible to obtain, in a positive manner, superimposed screen impressions without the risk of pollution by the intermixing of the inks, and to do this within a printing time the length of which varies with the amount of superimposed images to be inked.

This serious restriction, due to the principle of these added units, to a great extent limits their use and does not enable the printer to regard his press, equipped with this accessory, as a true two-color press.

The evolution of graphic style, of tastes and of printing techniques makes it necessary to produce multicolor prints inexpensively. For many printers not specializing in color printing the purchase of a two-color press is a problem, because the cost and size of such a press are twice those of a single-color press, thus making amortization difficult. This factor is all the more important in

the case of high quality presses for relatively small formats, of the GTO type, which for long runs of four-color printing find it difficult to compete with presses for double or quadruple format. In addition, a two-color press is poorly suited to one-color printing.

BRIEF DESCRIPTION OF THE DRAWINGS

The novel features believed characteristic of the invention are set forth in the appended claims. The invention itself however, as well as a preferred mode of use, further objects and advantages thereof, will best be understood by reference to the following detailed description of an illustrative embodiment when read in conjunction with the accompanying drawings, wherein:

FIG. 1 is a simplified side view of a prior art Heidelberg press;

FIG. 2 is a simplified side view of a prior art Heidelberg press with a detachable letter press numbering unit attached thereto;

FIG. 3 is a simplified side view of a Heidelberg press of the present invention especially adapted according to the present invention with an auxiliary blanket cylinder and a detachable plate cylinder and inking module, which allows two color printing with a single press run;

FIG. 4 depicts the improved press of the present invention with the detachable plate cylinder and inking module configured in an alternate mode of operation from that shown in FIG. 3 to allow the detachable plate cylinder to act upon the press blanket cylinder;

FIG. 5 is a view of the improved printing press of the present invention in a storage position;

FIG. 6A is a view of the prior art press from the delivery side of the blanket cylinder;

FIG. 6B is a view of the prior art press with the numbering cylinder of the detachable dual mode numbering and additional coloring device connected thereto, shown in a numbering configuration;

FIG. 7A is a view of the prior art press with the coloring cylinder of the detachable dual mode numbering and additional coloring device connected thereto, shown in an additional coloring configuration;

FIG. 7B is a view of the improved printing press of the present invention from the delivery side of the blanket cylinder with an auxiliary blanket cylinder coupled in place of the numbering/coloring cylinders;

FIG. 8A is a view of the auxiliary blanket cylinder of the present invention;

FIG. 8B is a view of a gear which is coupled to the prior art press to accommodate the operation of the auxiliary blanket cylinder and detachable module;

FIG. 9 is a partial sectional view of the detachable auxiliary plate cylinder and inking module of the present invention; and

FIG. 10 is a side view of the detachable auxiliary plate cylinder and inking module of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The present invention seeks to improve the present state of the art by making it possible to produce compact offset presses offering increased facilities to the printer.

Within the scope of the invention the additional means provided for a traditional offset printing press can be defined generally as follows:

(a) a detachable inking module of traditional, known type whose inking power usually corresponds to that of the press and which has its own dampening unit, inking unit and plate cylinder, as well as all the mechanisms enabling the offset plate to be inked in chronological order.

(b) a detachable blanket cylinder mounted on the shaft of the numbering or additional color letterpress device of the press and replacing said device.

Starting with these two components of the printing unit, and depending on their arrangement on the press, the printer can at will, and within a short time, convert his single-color press either into a true two-color press offering the same possibilities and performance as a two-color press built on the basis of two presses, or into a single-color press plus an additional color and a numbering unit.

A third facility is offered in these presses provided with means for fitting these different components, namely the ability to mount another added unit on the press converted into a true two-color press.

If the press which is to be equipped with an additional printing unit is not provided with a numbering device, a device of this kind can be added and its drive shaft will be used in the same manner as with a press originally equipped to support and drive the blanket cylinder.

In addition to the fitting of the additional units to existing presses, the construction of presses directly fitted during their production with the same detachable modular components, without departing from the scope of the present invention, is also desirable, because this makes it possible to produce, at lower cost, two-color machines which can equally well print one or two colors or twice two colors and which are much more compact and easy to use, while offering not negligible additional facilities. It is quite obvious that the printing unit may allow wide variations in its inking or dampening methods or may effect waterless offset printing, without departing from the scope of the invention.

These different possibilities are of great interest to the printer, because in the case of color superimposition printing there is rarely a need for numbering, whereas numbering jobs often require an additional color.

FIG. 3 shows the printing unit in which the detachable inking module **16** works with its blanket cylinder **7C** to provide an additional color by color superimposition in conjunction with the color of the press. This blanket cylinder **7C** is mounted direct on the same shaft **9** which carries the rings **9A** (FIG. 2) carrying numberers **9B**. The drive is provided by the gear **8** (FIG. 9), which serves to operate the letterpress inking and additional printing unit **7A** (FIG. 2) used for numbering.

The plate cylinder **17** (FIG. 3) is provided with all the usual devices for the tensioning and alignment of the plate, as well as for circumferential and axial adjustment to allow good positioning of the printing on the sheet. The dampening unit **18** transfers the moistening liquid from its reservoir **19** to the plate cylinder **17** with the aid of the conventional system comprising the water ductor **20**, feed roller **21**, sliding table **22**, moistening roller **23**, and plate moistening rollers **24**. The ink contained in the duct **25** is fed and and ground as far as the plate inking rollers **24A** inking the offset plate with the aid of the duct rollers **26**, distribution rollers **23A**, and grinding cylinder **22A**. The sheet of paper **5** taken from the stack **5A** is pressed in succession by the pressure cylinder **4** first against the blanket cylinder **3** normally installed on the press and printing the first color, and then secondly against the blanket cylinder **7C**, which prints the second color. The sheet **5**, having received the inks of two

colors, is taken over by the grippers of the chain delivery device 6 and deposited on the delivery stack 5B.

The inking module 16 is supported by two bearings 27, whose detachable caps 28 (FIG. 5) hold the shafts 29A (FIG. 9) in position, thus enabling the inking module 16 to follow the slight movements of the shaft 9 (FIG. 3) of the additional blanket cylinder 7C for the application of pressure when the press is printing and for the relaxing of pressure when it is stopped. The ability to remove quickly the caps 28 (FIG. 5) of the bearings 27 makes it possible to change over very quickly from the arrangement shown in FIG. 3, using the additional blanket cylinder 7C fastened to the shaft 9 provided for carrying the numberers, to the arrangement shown in FIG. 4 in which the plate cylinder 17 of the inking module 16 is used to apply the ink of the second color to the blanket of the blanket cylinder 3, the ink of the first color having already been applied to it by the plate cylinder 2 of the press. In this arrangement the numbering and additional letterpress color system is normally used.

FIG. 5 shows the inking module 16 in the stored position, out of use.

For greater ease and greater accuracy in the movement and positioning of the inking module 16, manipulation is assisted by a mechanism which retracts during printing and which works in the following manner. Pneumatic struts 29 bear against the frame 1 of the press, and lifting arms pivoted on the bearings 31 fixed on the frame 1 of the press raise the inking module 16 by means of connecting rods 32 pivoted on the arms 30 by the pins 33 and on the inking module 16 by the pins 34. An eccentric shaft 31A operated by a lever 31B enables the device to be deposited on the top of the printing press frame in the position of rest.

The invention, as characterized in the claims, is described below in detail with the aid of the drawings accompanying the text and illustrating one of the preferred embodiments in its different printing versions and fitted to a GTO Heidelberg press.

FIG. 6, View A, is a front view on the press delivery side of the blanket cylinder 3 on which is fixed and adjusted a gear 3A enabling the inking module 16 (FIG. 3) to be driven in the position for printing two superimposed colors. The gear 8 (FIG. 6) serves as a power take-off driving the shaft 9 serving as rotating support either for the disks 9A (FIG. 6, View B) on which the numberers 9B are fixed, or for the sleeve 9C (FIG. 7, view A) to which the letterpress blocks are secured by adhesive bonding, or else for the performance of the invention for the blanket cylinder 7C (FIG. 7, View B) on which the plate cylinder 17 (FIG. 3) of the inking module 16 will deposit ink from its plate representing the image to be printed. The micrometer screws 7B (FIG. 2) for pressure adjustment, which are provided for letterpress printing, serve the same function for offset printing. The bearings 27 and 27A and their caps 28 and 28A enable the inking module 16 (FIG. 3) to be supported and positioned on the press in its two operating positions. The ring 8A (FIG. 6, View A) positions and serves as support for the bearing 9D (FIG. 8, View A) of the movable support shaft 9 (FIG. 6, View B). The device for the automatic release of pressure in the event of no sheet being fed also operates for two-color offset printing.

FIG. 6, View B, shows the same section of the press as View A, and in addition shows the rotating support shaft 9 connected to the power take-off gear 8 and the ring 8A serving to support it, said shaft turning in phase with the machine and carrying, mounted on it before it is fitted, the disks 9A and the numberers 9B.

FIG. 7, View A, shows, for the sake of good understanding of the invention, the same section in which the disks 9A (FIG. 6, View B) carrying the numberers 9B have been replaced by the sleeve 9C (FIG. 7, View A), on which are fixed the letterpress blocks and which is mounted on the same rotating support shaft 9.

FIG. 7, View B, shows the same section, in which the sleeve 9C (FIG. 7, View A) has been replaced with the blanket cylinder 7C, provided with its impression blanket 7D and mounted on the rotary support shaft 9 driven by the gear 8.

FIG. 8, View A, shows a construction of the blanket cylinder 7C mounted on the rotating shaft 9 driving it. The rotating shaft 9 drives the blanket cylinder 7C directly, said cylinder being prevented from turning on said shaft by the key 10 and from making translatory movements by the stop screws 11. The blanket 7D is gripped between the tensioning bars 12 and the clamp bars 13 held by the screws 13A. The tightening of the spherical head screws 14 effects the normal tensioning of the blanket 7D by being screwed into the cylindrical nuts 15, which brings about the rocking of the tensioning bars 12 on the blanket cylinder 7C.

FIG. 8, View B, shows the gear 3A permanently positioned on the shaft of the blanket cylinder 3 (FIG. 6). In cases where the inking unit is fitted to existing presses, this gear is made in two halves in order to enable it to be installed without having to dismantle the printing press. It is machined with extreme precision in order to ensure perfect rotation of the gear teeth, without eccentricity or wobble. The screws 3B hold the two gear halves together, and at the same time ensure clamping on the blanket cylinder shaft by a pinching action.

FIG. 9 shows a partial section of the inking module 16, illustrating the general principles applied for depositing the ink on the blanket cylinder 7C. The plates 35 supporting the components of the inking module 16 are attached to the printing press by means of shafts 29*a* pivoting in the supports 27 with the aid of ball bearings 27B. The plate cylinder 17 turning in its bearings 17A carries at one end of its shaft 17B the gear 17C keyed on it and driven rotationally by the drive gear 3C of the printing press. The gear 36 turning on its stationary shaft 37 operates the connecting rod 38 by means of the eccentric crankpin 39 mounted on a ball joint. The connecting rod 38 in turn moves the lever 40 which is pivoted on the support 40A by means of the pin 40B and whose rollers 41 alternately push to the right, and then to the left, the sliding tables 22A and 22B serving to grind the ink. These tables are driven rotationally by the gear 36 and the gear 42, the number of teeth of which enables them to obtain the same circumferential speed as the plate cylinder 17, the ink transfer rollers 23A and plate inking rollers 24A thus being driven by simple contact with light pressure. This pressure is adjusted by the combined rotations of the eccentric bearings 43 acting on the pressure against the sliding table 22A, and of the eccentric shaft 44 of the plate inking rollers 24A acting on the pressure against the plate on the plate cylinder 17. One end of the eccentric shaft 44 carries a crank 45 connected by a connecting rod 46 to the single control lever 47 (FIG. 10). Each plate inking roller 24A (FIG. 3) and plate moistening roller 24 is connected in the same manner to the single control lever 47 (FIG.

10). Depending on the position of the latter, it is possible to bring the assembly of plate inking rollers 24A or the assembly of plate moistening rollers 24 into or out of contact with the plate on the plate cylinder 17 (FIG. 3). The gear 42 (FIG. 9) carries at one end a cogged pulley 48 which with the aid of a cogged belt 49 turns the cogged pulley 50 keyed on the shaft 51 with a reduction ratio such that the shaft 51 makes one rotation for every format printed. The cam 52 keyed on the shaft 51 thus raises the cam roller 53 fixed at the end of the lever 54 for each impression cycle. The lever 54 is keyed to one end of the shaft 55, to the other end of which is keyed the lever 56, which thus permits the to-and-fro movement of the ink feed roller 26 turning on the shaft 26*a* fixed at one end on the lever 56 and at the other end on the lever 56A pivoted on the shaft 55A. In the forward movement the ink feed roller 26, bearing against the ink ductor 20A of the duct 25, becomes coated with ink, which it deposits on the sliding table 22B at the end of the return movement. The rotating shaft 51 carries at one end the crank 57, on which pivots the connecting rod 58 fixed to the lever 59. This lever is mounted pivotally on the shaft 20B of the ink ductor roller 20A with the aid of the free wheel 60. In its oscillation, the movement of the lever 59 thus turns the ink ductor roller 20A a few degrees in the same direction with the aid of the free wheel 60, which roller is thus coated in the ink reservoir 25, the flow from which is ensured by adjustment screws 61. Screws 62 and 62A keep the ink reservoir 25 closed, although it can be opened for washing by turning it about pins 63 and 63A. It should be noted that the kinematics of the moistening liquid distribution system is in general arranged in the same manner as the kinematics of the ink distribution system. Protective casings 64 and 64*a* prevent direct access to the mechanical systems, which could be dangerous to the user.

FIG. 10 shows the inking module 16 on which all the controls necessary for the correct use of the module are disposed. The lever 65, with index and graduated scale, regulates the amplitude of the rotary movement of the ink ductor roller 20A (FIG. 9) by acting on the pawl of he free wheel 60. The lever 65A (FIG. 10) enables the ink ductor roller 20A (FIG. 9) to be turned by hand. The screws 61 regulate the coating of the ink ductor roller 20A, thus acting, conjointly with the selection of the position of the lever 65 (FIG. 10), on the amount of ink deposited on the plate on the plate cylinder 17. The lever 66, which is also provided with an index and graduated scale, regulates the amplitude of the rotation of the moistening liquid ductor roller 20 (FIG. 3), thus acting directly on the flow of liquid deposited on the plate on the plate cylinder 17. The lever 66A enables the moistening liquid ductor roller 20 (FIG. 3) to be turned by hand. Judicious adjustment of the screws 61 (FIG. 10) and of the levers 65 and 66 thus makes it possible to deposit on the plate on the plate cylinder 17 the amount of ink and moistening liquid most suitable for an excellent impression. The single four-position control lever 47 selects the different functions. In the "stop" position the connecting rods 46 (FIG. 9), which are not completely shown for the sake of clarity in the drawing and which are controlled directly by the single control lever 47 (FIG. 10), push the levers 45 (FIG. 9) into a position such that the eccentric shafts 44 move the moistening rollers 24 (FIG. 3) and inking rollers 24A away from the plate cylinder 17. In the "moisten" position of the single control lever 47 (FIG. 10) only the connecting rods 46 (FIG. 9) controlling the plate moistening rollers 24 (FIG. 3) are operated, thus bringing these rollers to bear against the plate on the plate cylinder 17 in order to effect the necessary moistening of said plate. In the "inking" position, the plate inking rollers 24A are in turn brought to bear against the plate on the plate cylinder 17. It should be observed that these operations are carried out without the plate cylinder 17 (FIG. 10) coming into contact with the blanket cylinder 7C. A cam is in fact keyed on the shaft 47A of the single control lever 47 to act on the roller 68 of the lever 69 pivoted by the pin 70 on a plate 35 of the inking module 16. The lever 69 bears directly against the frame 1 of the printing press to pivot the inking module 16 on its pivot pins 29A. In the "print" position the single control lever 47 turns the cam 67, the depression on which causes the lever 69 to pivot and the inking module 16 to rock in such a manner that the running tracks 17D (FIG. 9), known as bearers, of the plate cylinder 17 come to bear against the bearers 7E of the blanket cylinder 7C. The pressure is applied between plate and blanket, thus enabling ink to be transferred from the plate on the plate cylinder 17 to the blanket on the blanket cylinder 7C. The impression can now be made by pressing the sheet 6 (FIG. 3) between the pressure cylinder 4 and the blanket cylinder 7C.

Within the scope of the invention presses of larger formats can be equipped in the same way by employing the same means which characterize the invention in its claims taken as a whole.

I claim:

1. In a printing press having:

a plate cylinder;

a means for linking said plate cylinder in a first color with a first ink;

a blanket cylinder in circumferential contact with said plate cylinder for receiving images from said plate cylinder in said first ink;

a pressure cylinder in adjustable circumferential contact with said blanket cylinder;

a feed means for drawing paper between said pressure cylinder and said blanket cylinder to deposit said images in said first ink on said paper;

a drive means for rotating said plate cylinder, blanket cylinder, and said pressure cylinder;

a detachable dual mode numbering and coloring device including a inking unit in circumferential contact with a removable numbering cylinder, said removable numbering cylinder being in circumferential contact with said pressure cylinder and rotated by said drive means, for printing page numbers on said paper drawn between said removable numbering cylinder and said pressure cylinder when in a numbering mode, and with said inking unit in circumferential contact with a removable coloring cylinder, said removable coloring cylinder being in circumferential contact with said pressure cylinder and rotated by said drive means, for printing images in a second ink of a second color on said paper drawn between said removable coloring cylinder and said pressure cylinder when in a coloring mode;

the improvement comprising:

a removable auxiliary blanket cylinder adapted for attachment in the press in the location provided for the removable numbering and coloring cylinders, and for rotation by said drive means; and

a movable inking module coupled to said printing press, including an inking unit, a damping unit, and

an auxiliary plate cylinder, operable in a first mode with said auxiliary plate cylinder in circumferential contact with said auxiliary blanket cylinder for depositing images in a third ink of a third color on said paper, and operable in a second mode with said auxiliary plate cylinder in circumferential contact with said blanket cylinder for depositing images in a third ink of a third color on said paper while allowing simultaneous operation of said detachable dual mode numbering and color device.

2. A printing press according to claim 2, wherein the said movable inking module is suspended along said press by a pivoting arm.

3. A printing press according to claim 2, wherein said movable inking module is suspended along said press by a pivoting arm and configurable in three positions relative to said press, including a first position with said auxiliary plate cylinder in circumferential contact with said auxiliary blanket cylinder in said first mode of operation, a second position with said auxiliary plate cylinder in circumferential contact with said blanket cylinder in said second mode of operation, and a third position with said movable inking module placed in a storage position.

4. A printing press comprising in combination:
a plate cylinder;
a means for inking said plate cylinder in a first color with a first ink;
a blanket cylinder in circumferential contact with said plate cylinder for receiving images from said plate cylinder in said first ink;
a pressure cylinder in adjustable circumferential contact with said blanket cylinder;
a feed means for drawing paper between said pressure cylinder and said blanket cylinder to deposit said images in said first ink on said paper;
a drive means for rotating said plate cylinder, blanket cylinder, and said pressure cylinder;
a removable auxiliary blanket cylinder adapted for attachment in the press adjacent said pressure cylinder and rotatably by said drive means;
a movable inking module coupled to said printing press, including an inking unit, a damping unit, and an auxiliary plate cylinder, operable in a first mode with said auxiliary plate cylinder in circumferential contact with said auxiliary blanket cylinder for depositing images in a second ink of a second color on said paper, and operable in a second mode with said auxiliary plate cylinder in circumferential contact with said blanket cylinder for depositing images in a second ink of a second color on said paper.

5. A printing press according to claim 4, wherein movable inking module is suspended along said press by a pivoting arm.

6. A printing press according to claim 5, wherein said movable inking module is suspended along said press by a pivoting arm and configurable in three positions relative to said press, including a first position with said auxiliary plate cylinder in circumferential contact with said auxiliary blanket cylinder in said first mode of operation, a second position with said auxiliary plate cylinder in circumferential contact with said blanket cylinder in said second mode of operation, and a third position with said movable inking module placed in a storage position.

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US005115741A

United States Patent [19]

Rodi

[11] **Patent Number: 5,115,741**

[45] **Date of Patent: * May 26, 1992**

[54] **DEVICE FOR DRYING PRINTED PRODUCTS IN A PRINTING MACHINE**

[75] Inventor: **Anton Rodi**, Leimen, Fed. Rep. of Germany

[73] Assignee: **Heidelberger Druckmaschinen AG**, Heidelberg, Fed. Rep. of Germany

[*] Notice: The portion of the term of this patent subsequent to Feb. 12, 2008 has been disclaimed.

[21] Appl. No.: **634,692**

[22] Filed: **Dec. 27, 1990**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 398,631, Aug. 25, 1989, Pat. No. 4,991,506.

[30] **Foreign Application Priority Data**

Aug. 25, 1988 [DE] Fed. Rep. of Germany 3828753

[51] **Int. Cl.**^{5} **B41F 23/04**

[52] **U.S. Cl.** **101/424.1**; 101/416.1; 118/DIG. 1

[58] **Field of Search** 101/416.1, 424.1; 34/4, 34/41; 118/DIG. 1

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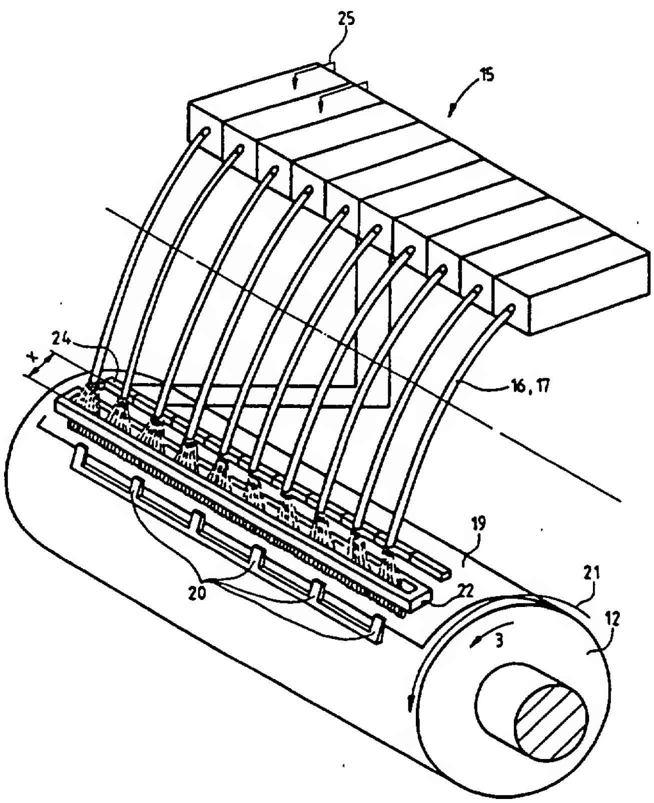
Primary Examiner—Edgar S. Burr
Assistant Examiner—Ren Yan
Attorney, Agent, or Firm—Herbert L. Lerner; Laurence A. Greenberg

[57] **ABSTRACT**

A device for drying printed products in a printing machine having a transport device for conveying printed products along a given path includes a radiation device located outside the printing machine for generating radiant energy, and a device for transmitting the radiant energy generated by the radiation device to a surface of the printed product, the transmitting device being disposed at least partly in the printing machine so as to direct the radiant energy simultaneously over a defined width of the surface of the printed product.

14 Claims, 5 Drawing Sheets



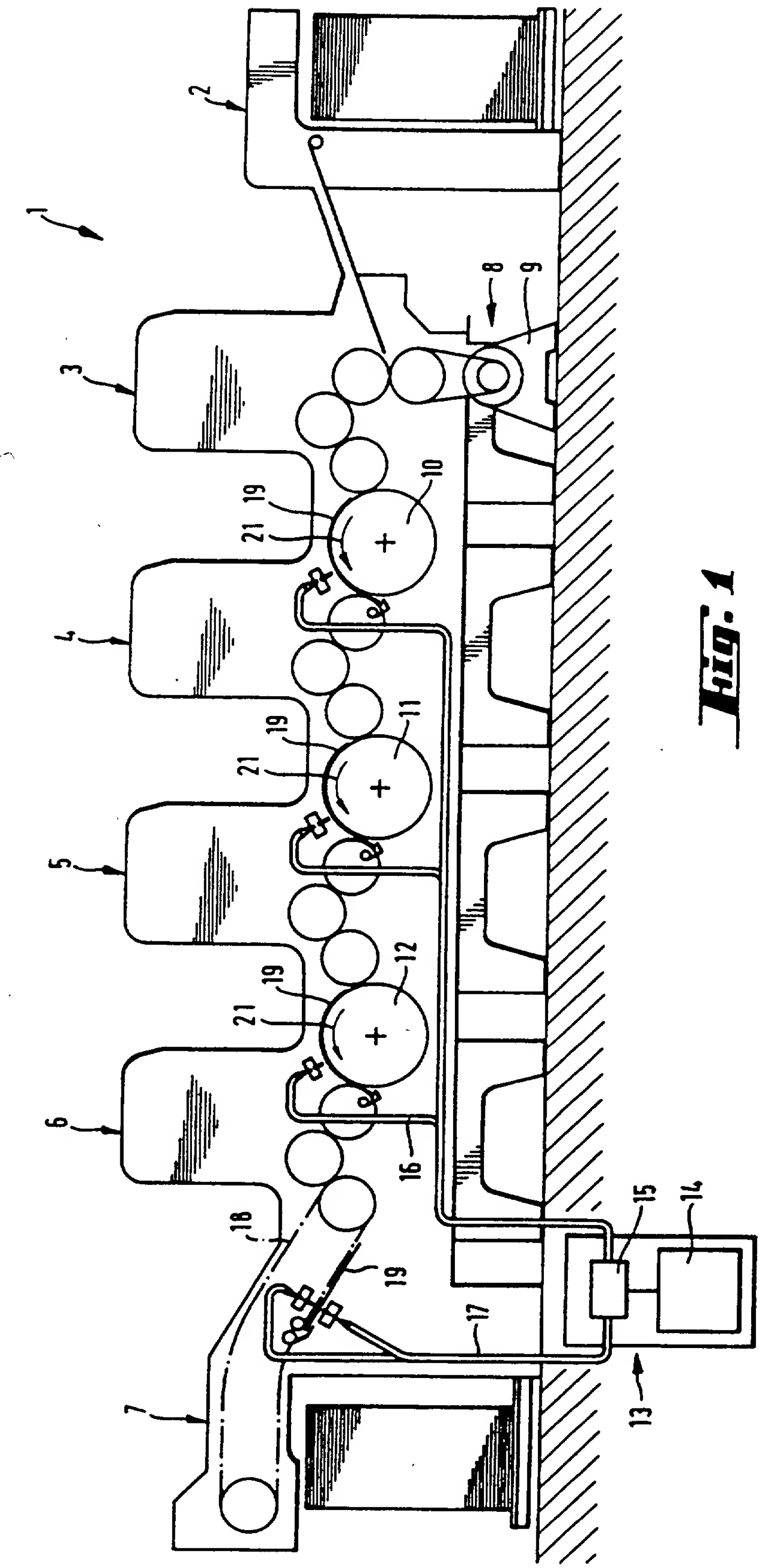
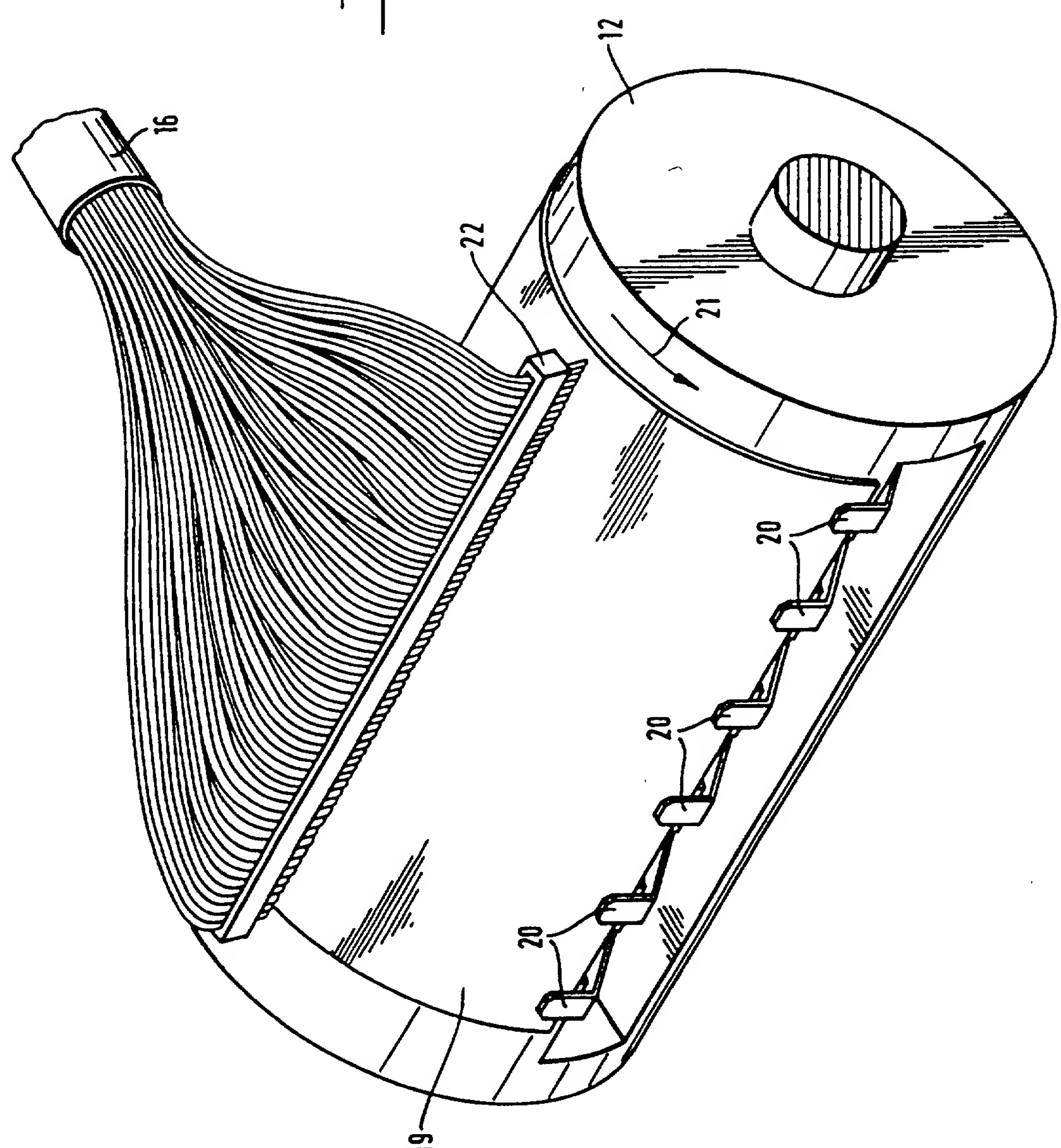


Fig. 1

Fig. 2



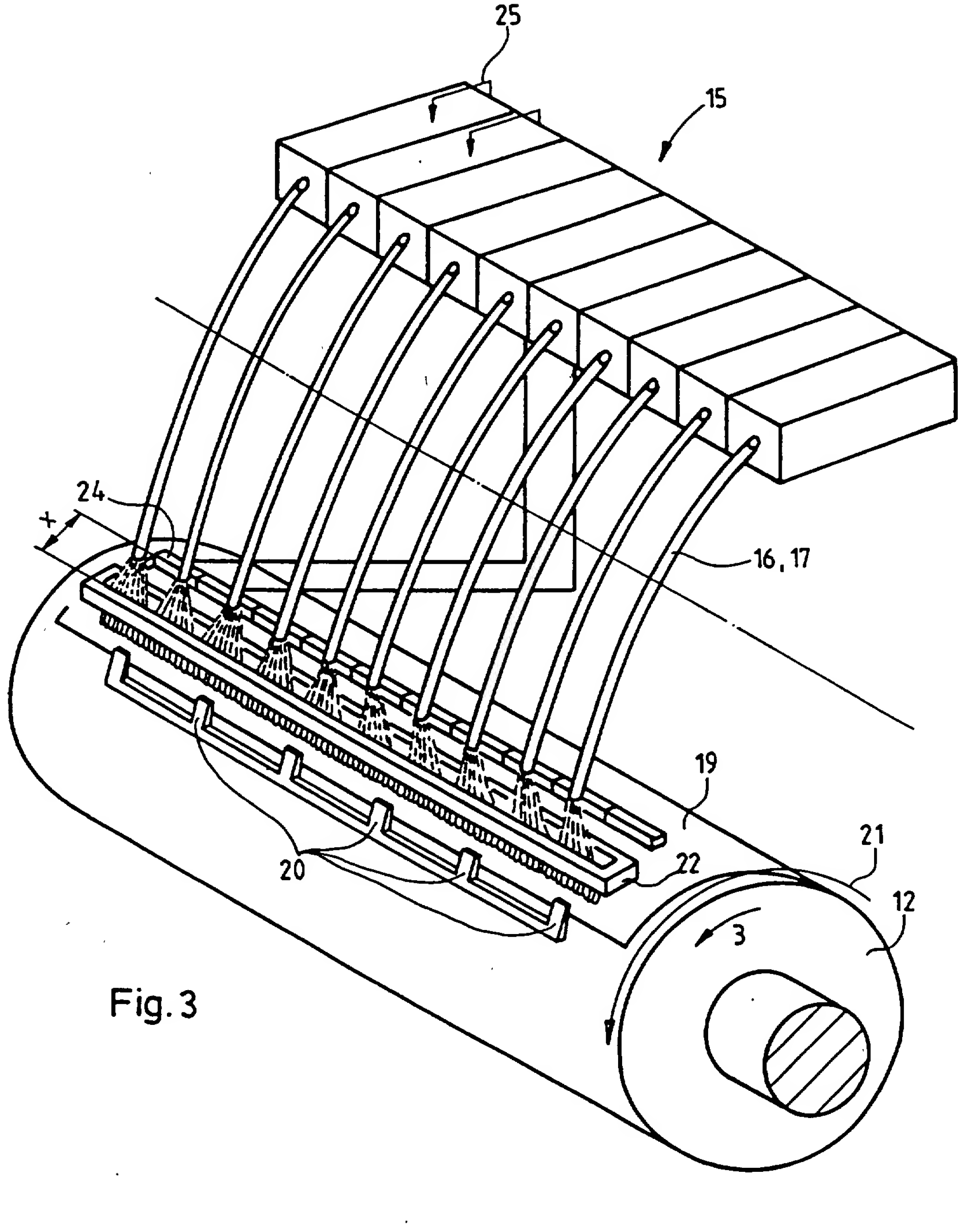


Fig. 3

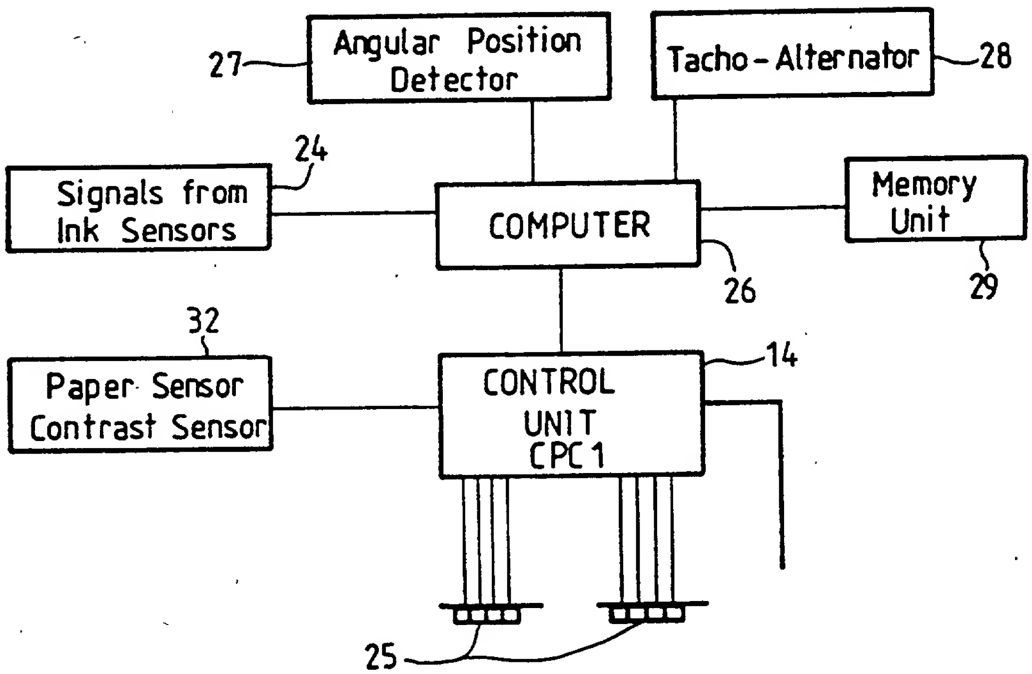
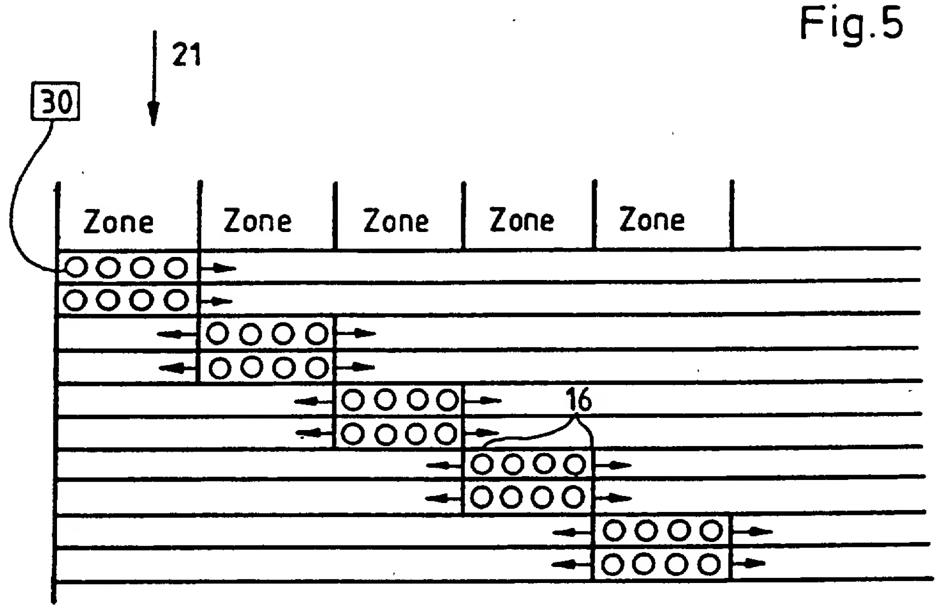

Angular Position Detector
27
Tacho-Alternator
28
Signals from Ink Sensors
24
COMPUTER
26
Memory Unit
29
32
Paper Sensor Contrast Sensor
CONTROL UNIT CPC 1
14
25

Fig. 4

Fig.5



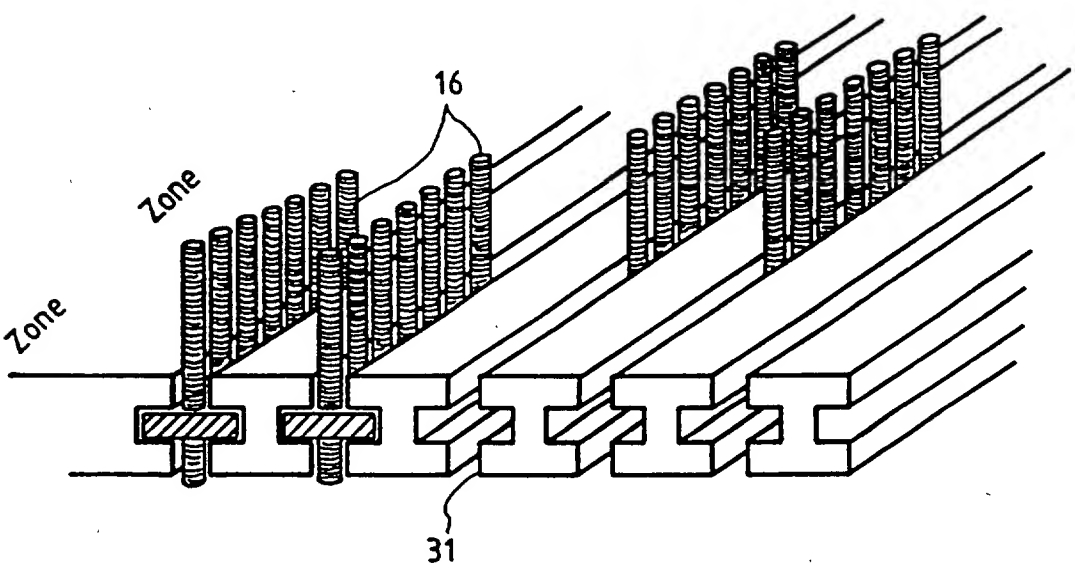


Fig.6

DEVICE FOR DRYING PRINTED PRODUCTS IN A PRINTING MACHINE

CROSS-REFERENCE TO RELATED APPLICATION

This application is a Continuation-In-Part of application Ser. No. 398,631, filed Aug. 25, 1989, now U.S. Pat. No. 4,991,506, issued on Feb. 12, 1991.

The invention relates to a device for drying printed products in a printing machine and, more particularly, a printing machine having a transport device for conveying printed products.

A device in which a laser light source generates a laser beam has become known heretofore from published Japanese Patent Application 59-133058. This laser beam is guided by a rotating polygonal mirror onto a printed product which is moved continuously underneath the laser beam. By means of this rotating polygonal mirror, the laser beam oscillates over the width of the printed product and effects a heating and, thereby, a drying of the printing ink which has been applied to the printed product.

This heretofore known device has a disadvantage in that the laser beam heats the printed product only at a point. This demands a very high energy density because the point of impingement of the laser beam must be guided over the printed product at high speed in order to cover the entire area thereof. Moreover, a drive unit is required for the polygonal mirror.

A further disadvantage of the foregoing heretofore known device is that the radiation device must be placed as much as possible in the proximity of the freshly printed product i.e. in the printing machine itself, in order to avoid long beam paths. Because the radiation device produces a considerable amount of heat due to energy loss, undesired local heating, even of printing machine parts, occurs. Such local heating within the printing machine is detrimental to the operability of the in-register bearings, on the one hand, and, presents the risk of register errors in the printed image caused by the thermal expansion of certain mechanical parts, on the other hand.

Heretofore, attempts have been made, in fact, to prevent this heating of printing machine parts by placing the radiation device at a given distance from the directly neighboring parts of the printing machine so that ventilation of the radiation device was possible. This requires a very large installation space, however. Especially in the case of a printing machine, such additional bulky or large volume parts are very disadvantageous and disruptive because the installation space which is available is needed for other parts, e.g. sensors or adjusting elements, and because all parts of the printing machine should be readily accessible from the outside.

It is accordingly an object of the invention to provide a drying device of the foregoing general type which succeeds in eliminating negative influences exerted on the printing machine which are caused by dissipated heat from the radiation device and achieving ink drying as rapidly as possible by optimally utilizing the radiant energy.

With the foregoing and other objects in view, there is provided, in accordance with the invention, a device for drying printed products in a printing machine having a transport device for conveying printed products along a given path, comprising a radiation device located outside the printing machine for generating radiant energy, and means for transmitting the radiant energy generated by the radiation device to a surface of the printed product, the transmitting means being disposed at least partly in the printing machine so as to direct the radiant energy simultaneously over a defined width of the surface of the printed product.

An important advantage of the construction of the invention is consequently that unnecessary heating in the printing machine is avoided by placing the radiation device, which may be a laser beam source, for example, outside the printing machine. The laser beam is transmitted by suitable transmitting means having low energy loss or dissipation. It is, furthermore, advantageous to have the radiation energy impinge simultaneously on the entire width of the surface of the printed product or on a linear part thereof. Thus, radiation energy does not impinge on the printed product point by point, but rather, a line at a time, which has a better drying effect and results in a higher drying speed.

In accordance with another feature of the invention, the transmitting means comprise a fiber-optics cable operatively connected to the radiation device for receiving therefrom the radiant energy generated thereby. By means of optical fibers, it is possible to bridge great distances between a radiation device and the location where the radiation energy is used. If the fiber-optics cable is formed of a plurality of individual fibers, its end can be fanned out linearly i.e. the individual optical fibers can be separated or split into one or more rows terminating just above the surface of the printed product. The width of such a row corresponds to the width of the surface to be dried.

In accordance with a further feature of the invention, the transmitting means comprise at least one gas-filled tube operatively connected to the radiation device for receiving therefrom the radiant energy generated thereby. It is recommended that nitrogen be used for the gas filling or content. With such a tube it is also possible to realize very long guide paths. For generating a line of radiation energy, an optical beam splitter is provided at the end of the tube.

In accordance with a further feature of the invention, the transmitting means comprise an elongated member having a substantially linear-shaped end facing in a direction towards the printed product and being locatable above the surface of the printed product.

In accordance with an added feature of the invention, the end of the elongated member facing towards the printed product has an optical beam splitter for directing the radiant energy linearly onto the surface of the printed product.

Ultraviolet (UV) inks presently employed in offset printing are cured by being exposed to ultraviolet light. When compared to solvent-containing inks, UV inks have the advantage that they are dried without unnecessarily heating the printed products. It is, therefore, expedient, in accordance with yet another feature of the invention, to provide a radiation device having means for generating radiation having a wavelength which lies within the ultraviolet range.

In accordance with yet a further feature of the invention, the gas-filled tube has an inner coating for reflecting radiant energy. The gas-filled tube may thus be provided with an inner coating which reflects ultraviolet light. Such an inner coating permits the tube to be arbitrarily placed in position just like an optical fiber or

fiber-optics cable. Deflecting mirrors and straight tube conduit or guidance are not required.

In accordance with yet an additional feature of the invention, wherein the printed product has an ink application thereon of varying structure, the device further comprises sensor means for determining the structure of ink application on the printed product, and a control device for receiving signals from the sensor means corresponding to a determined structure of ink application on the printed product and varying the intensity of the radiant energy in accordance with the determined structure of ink application on the printed product.

The entire device can be integrated into a control circuit for controlling the radiation energy which is to be supplied. Because the entire area of a printed product is very seldom printed on, the printed product having blank or non-image areas very often, it is advantageous not to have any radiation or radiant energy impinge on the non-image areas of the printed product or printed sheet. This means that radiant energy is fed only to those areas of the printed sheet which need it for drying the ink. The control device which controls the radiant energy is fed via sensors with the information on the inked and non-inked areas, respectively, of the printed product. The sensors are directed onto the printed sheet in the same manner, for example, as is the impingement line of the radiation energy, and scan or determine the application of ink on this sheet. Signals generated by the sensors are fed to the control device which controls the intensity of the radiation energy by means of these signals.

Instead of such a sensor arrangement, in accordance with yet an added feature of the invention, the device is provided with electronic memory means wherein data regarding the structure of the ink application on the printed product are storable, the memory means being operatively connected to the control means for receiving stored data therefrom and for controlling the intensity of the radiant energy in accordance with the stored data. By reading out the memory contents cyclically and feeding them to the control device, the radiation intensity and the switching of the radiation or radiant energy, respectively, are controlled in a similar manner.

In accordance with a concomitant feature of the invention, the radiation device has means for generating radiant energy of varying wavelengths, and means for selecting radiant energy of a given wavelength to be generated thereby in accordance with at least one characteristic of an ink to be dried. An advantage thereof is that it is possible thereby to dry inks which become cured in different ultraviolet wavelength ranges. Respective ultraviolet-wavelength ranges are selected depending upon the inks which are used, and the radiation device is activated by the respective wavelength.

Other features which are considered as characteristic for the invention are set forth in the appended claims.

Although the invention is illustrated and described herein as embodied in a device for drying printed products in a printing machine, it is nevertheless not intended to be limited to the details shown, since various modifications and structural changes may be made therein without departing from the spirit of the invention and within the scope and range of equivalents of the claims.

The construction and method of operation of the invention however, together with additional objects and advantages thereof will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

FIG. 1 is a sheet-fed printing machine including a drying device according to the invention;

FIG. 2 is a fragmentary perspective view of FIG. 1 showing a fiber glass cable above a printed product which is to be dried;

FIG. 3 is a perspective view of a second embodiment showing a plurality of fiber glass cables leading from a laser tube array to just above the printed product which is to be dried;

FIG. 4 is a diagrammatic view of a computer and printing control unit configuration;

FIG. 5 is diagrammatic top-plan view of a fiber-optics array with transversly slidable fiber-optics bundles; and

FIG. 6 is a perspective view of the array of FIG. 5 showing several fiber-optics bundles slidably disposed in an I-beam configuration.

Referring now to the drawings and first, particularly, to FIG. 1 thereof, there is shown diagrammatically a sheet-fed offset printing machine having a sheet feeder 2, four printing units 3, 4, 5 and 6 and a sheet delivery 7. An electric motor 9 serves as the drive 8 of the printing machine. Transfer drums 10, 11 and 12 are arranged between the individual printing units, and convey sheets from one printing unit to the next. Sheet transport is effected longitudinally along a transport path represented by the arrow 21 (FIG. 2). While a printed sheet 19 is transported by the transfer drums 10, 11 and 12, the printed side of the sheet 19 faces outwardly so that it is possible for the freshly printed surface to pass a drying device. An appropriate drying device is made up of several components of which a first component is a device for generating radiation energy such as a laser radiation device 13. Such a laser radiation device 13 includes an electronic control unit 14 and a laser tube 15. This laser radiation device 13 is known, for example, from the publication "Lambda Physik Laserstrahltechnik" by Lambda Physik GmbH, Gottingen, Federal Republic of Germany.

The laser beam which is generated by the laser tube 15 is fed into a fiber-optics cable 16, 17 formed, for example, of a bundle of optical fibers constituting other components of the drying device. The entire laser radiation device 13 is accommodated in an appropriate housing outside the printing machine 1. The fiber-optics cable 16, 17 is the only connection between the laser radiation device 13 and the printing machine 1. The ends of the fiber-optics cable 16 extend towards and close to the transfer drums 10, 11 and 12 of the individual printing units 3, 4, 5 and 6 and terminate shortly above the outer cylindrical surfaces of these transfer drums 10, 11 and 12. The ends of the fiber-optics cable 17 run to a chain delivery 18 which conveys the printed sheets to the sheet delivery 7. Thereafter, both sides of the printed sheets are dried in the region of the chain delivery. Moreover, the ink and/or varnish coating applied by the printing unit 6 are dried.

An embodiment of the end of a fiber-optics cable 16 is shown in detail in FIG. 2. The printed sheet 19 on the transfer drum 12 is held fast at its leading end by grippers 20 and conveyed longitudinally along the transport path 21. The end of the fiber-optics cable 16 is attached to a traverse or cross-bar 22 located above the transfer drum 12 and suitably secured to non-illustrated side frames of the printing machine. As is apparent from FIG. 2, the fiber-optics cable 16 is split up i.e. the indi-

vidual fibers of the cable are arranged so that they form a line extending transversely to the transport direction of the sheet 19. The laser beam emerging from the ends of the fiber-optics cable 16 strikes the sheet surface almost vertically.

Given a sufficient number of individual optical fibers, it is also possible to arrange several rows of optical fibers one behind the other. A longer exposure of the sheet to radiation during its transport movement results therefrom and thus ensures reliable curing of the ink at very high transport speeds.

Instead of a single laser tube 15, as shown in FIG. 1, it is also possible to arrange several laser tubes in a laser tube array. This feature is illustrated in FIG. 3. Each of the lasers is capable of generating a laser beam of a given wavelength. The laser beams of varying wavelengths are fed to the individual printing units via a plurality of fiber-optics cables. Due to this multiple laser, each printed ink is cured optimally in accordance with its absorption behavior and its curing properties.

It is further shown in FIG. 3 that the radiation device in the form of a laser tube array is disposed outside the printing machine at a distance from the transfer drum 12. This avoids unnecessary and undesirable heating of the printing machine in the region of the printing cylinders. A fiber-optics bundle is split open and arranged in such a manner just above the freshly printed product 19 that a certain zone on the sheet is evenly irradiated and, accordingly, dried. Upstream of the fiber-optics cables 16, as seen in the rotational direction of the transfer drum 12 and in the transport direction 21 of the sheet, there are disposed ink sensors 24.

The sensors 24 obtain information regarding the ink surface distribution on the sheet along a scanned zone. The sensor means or sensors 24 may be in the form of densitometers as they are widely used, for example, in the CPC 2 and CPC 3 systems of Heidelberger Druckmaschinen AG. A non-illustrated computer connected to the electronic control unit 14 or which may be integrated in the control unit 14 then makes a simple computation. The information values involved are the spacing (x) between the ink sensors 24 and the line formed by the optical fibers held by the transverse bar 22, the rotational speed (ω) of the transfer drum 12 and the measurement values supplied by the ink sensors. The resulting computational values control the exact on and off times of the individual laser tubes, which are started by means of a corresponding starting or ignition electrode 25. This afore-described configuration leads to an optimized synchronization of the drying in accordance with the respective ink application.

In order for the ink sensors 24 to be particularly responsive to the specific ink to be dried in the respective printing unit, they can be adjusted by means of color filters. This avoids a double irradiation of the printed product. The wave length of the radiation generated by the radiation device 15 may be further varied with a corresponding choice of filler gas for the laser tube. In other words, the wave length of the lasers can be optimized with respect to the ink to be dried in the respective printing units. The wave length of the laser may be adjusted, for instance, by changing the laser gas. For instance, the above-mentioned reference Lambda Lasertechnik provides detailed instructions regarding wavelength and laser gas requirements.

Furthermore, it is possible to utilize so-called dichroic beam splitters in order to supply radiant energies with optimum wave lengths to the respective printing units. A dichroic beam splitter is a type of mirror which transmits a certain wave length of the light spectrum while reflecting all other wave lengths.

As illustrated in FIG. 4, the control operation is performed in the following manner:

The signals from the ink sensors are fed to a computing device or computor 26. In an alternative embodiment of the invention, these data may be determined in an off-line pre-measurement, i.e. outside the printing machine and then stored in a memory unit 29 associated with the computer 26. Such memory means 29 may be in the form of a magnetic or optical digital storage medium, such as a computer disk, digital tape, a laser disk, etc. In addition to the ink signal information coming from the sensors 24, the computer 26 receives information regarding the angular position and the rotational speed of the transfer drum. This information is obtained through an angular position detector 27 and a tacho-alternator 28. The detector 2 and the alternator 28 are usually connected to the axle of the transfer drum 12.

The exact moment for switching on or turning off the radiation device is computed from the known distance (x) between the line formed by the optical fibers and the ink sensors 24, together with the angular position and the angular speed of the drum 12. The result of this computation is fed to a control unit for the ignition electrodes 25, which start and stop the laser action. A further control supersedes the radiation control, namely a contrast sensor or paper sensor 32 prohibits the lasers from being started when no printed product 19 is present and ready to be dried, such as when the paper run is interrupted by the printing machine.

In summary, a plurality of fiber-optics bundles effect a drying of the ink by zones. The drying within the zones is controlled by the on and off time of the corresponding radiation device in the radiation array 15. Such drying is optimized with respect to the ink application in the zone.

A further embodiment of the invention is shown in FIGS. 5 and 6. While in the afore-described embodiment the laser radiation is either turned on or off, this further embodiment provides for a variation of the intensity of the irradiation distribution. The fiber-optics bundles are distributed among the zones in accordance with certain requirements. The number of fiber bundles as shown in FIG. 5 is two per zone. They may be moved along I-bars 31, which are disposed transversly to the direction of paper movement. In this embodiment only one laser is necessary, which means that the radiation cannot be controlled in a zone-by-zone manner. The fiber-optics bundles may be moved transversely to the direction of paper movement, i.e. from one zone to another. Accordingly, if a large amount of ink is detected in a certain zone, a higher number of fiber bundles is moved to that zone prior to the printing operation. Conversely, if a zone shows only a small amount of ink, then the bundles are moved away from that zone. Data regarding ink surface amount per zone are determined by a printing plate scanner, and the information is fed to a control unit 30, which effects a correspondingly optimal distribution of the fiber bundles among the zones. Again, a contrast sensor detects whether or not paper is present in the device, so that the device is only active, while paper is present in the printing machine.

It is also possible to apply a so-called ultraviolet excimer laser for generating a laser beam. With such ultraviolet radiation devices, excimers are formed by electric discharge under specific discharging conditions. Excim-

ers are molecular complexes e.g. Xe_2, which emit ultraviolet radiation when disintegrating. In this case, an ultraviolet radiation device which operates within a specific wavelength range ensuring optimum drying can be utilized for each desired application.

I claim:

1. Device for drying printed products in a printing machine having a transport device for conveying printed products along a given path, comprising a radiation device located outside the printing machine for generating radiant energy, and means for transmitting the radiant energy generated by the radiation device to a surface of the printed product, said transmitting means being disposed at least partly in the printing machine so as to direct the radiant energy simultaneously over a defined width of said surface of the printed product, said transmitting means comprising an elongated member having a substantially linear-shaped body with a fiber-optics cable having a multiplicity of optical fibers with ends thereof facing in a direction towards the printed product and being locatable above the surface of the printed product, and a transverse bar for arranging said ends of said optical fibers substantially along a line for directing the radiant energy linearly onto the surface of the printed product.

2. Device for drying printed products having an ink application thereon of varying structure in a printing machine having a transport device for conveying printed products along a given path, comprising a radiation device located outside the printing machine for generating radiant energy, and means for transmitting the radiant energy generated by the radiation device to a surface of the printed product, said transmitting means being disposed at least partly in the printing machine so as to direct the radiant energy simultaneously over a defined width of said surface of the printed product, said transmitting means comprising an elongated member having a substantially linear-shaped body with a fiber-optics cable having a multiplicity of optical fibers with ends thereof facing in a direction towards the printed product and being locatable above the surface of the printed product, sensor means for determining the structure of ink application on the printed product, and a control device for receiving signals from said sensor means corresponding to a determined structure of ink application on the printed product and varying the intensity of the radiant energy in accordance with the determined structure of ink application on the printed product.

3. Device according to claim 2, including electronic memory means wherein data regarding the structure of the ink application on the printed product are storable, said memory means being operatively connected to said control means for receiving stored data therefrom and for controlling the intensity of the radiant energy in accordance with said stored data.

4. Device according to claim 2, wherein said radiation device has means for generating radiant energy of varying wavelengths, and means for selecting radiant energy of a given wavelength to be generated thereby in accordance with at least one characteristic of an ink to be dried.

5. Device according to claim 2, wherein said sensor means are for determining the structure of ink application on the printed product by zones thereof and wherein said control device including means for varying the intensity of the radiant energy on zones of the printed product in accordance with the determined ink application structure on the zones of the printed product.

6. Device according to claim 5, wherein said sensor means are in the form of a printing plate scanner, and wherein said intensity varying means are in the form of a control unit for distributing said optical fibers among the zones for varying the intensity of radiant energy to the zones.

7. Device according to claim 2, wherein said transmitting means further include a gas-filled tube operatively connected between said radiation device and said optical fibers for transmitting the radiant energy from said radiation device to said optical fibers.

8. Device according to claim 2, including a contrast sensor for sensing the presence of printed product in the drying device and for causing said control device to turn on said radiation device only when printed product is present.

9. Device for drying printed products in a printing machine having a transport device for conveying printed products along a given path, comprising a radiation device located outside the printing machine for generating radiant energy, and means for transmitting the radiant energy generated by the radiation device to a surface of the printed product, said transmitting means being disposed at least partly in the printing machine so as to direct the radiant energy simultaneously over a defined width of said surface of the printed product, said transmitting means comprising an elongated member having a substantially linear-shaped body with at least one gas-filled tube operatively connected to said radiation device for receiving therefrom the radiant energy generated thereby, said gas filled tube having an end, and fiber optics means connected to said end of said gas-filled tube facing in a direction towards the printed product and being locatable above the surface of the printed product for transmitted the radiant energy from said end of said gas-filled tube to the printed product.

10. Device according to claim 9 wherein said radiation device has means for generating a laser beam having a wavelength within the ultraviolet range.

11. Device according to claim 9 wherein said gas-filled tube has an inner coating for reflecting radiant energy.

12. Device according to claim 9, wherein the printed product has an ink application thereon of varying structure, and further comprising sensor means for determining the structure of ink application on the printed product, and a control device for receiving signals from said sensor means corresponding to a determined structure of ink application on the printed product and varying the intensity of the radiant energy in accordance with the determined structure of ink application on the printed product.

13. Device according to claim 12, including electronic memory means wherein data regarding the structure of the ink application on the printed product are storable, said memory means being operatively connected to said control means for receiving stored data therefrom and for controlling the intensity of the radiant energy in accordance with said stored data.

14. Device according to claim 9, wherein said radiation device has means for generating radiant energy of varying wavelengths, and means for selecting radiant energy of a given wavelength to be generated thereby in accordance with at least one characteristic of an ink to be dried.

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Herbert et al.

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[54] LIQUID COATING APPARATUS FOR USE IN CONJUNCTION WITH PRINTING PRESSES WHERE ACCESS OF THE COATING APPARATUS TO THE PRESS CYLINDERS IS RESTRICTED

[75] Inventors: **John C. Herbert**, Huntington Bay, N.Y.; **Frank A. Andaloro**, Pawcatuck, Conn.

[73] Assignee: **Herbert Products, Inc.**, Westbury, N.Y.

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[51] **Int. Cl.**[5] **B05C 1/02**

[52] **U.S. Cl.** **118/46**; 118/249; 118/257; 118/231; 101/DIG. 48

[58] **Field of Search** .... 118/46, 211, 219, 221, 118/231, 249, 257; 101/DIG. 33, DIG. 48

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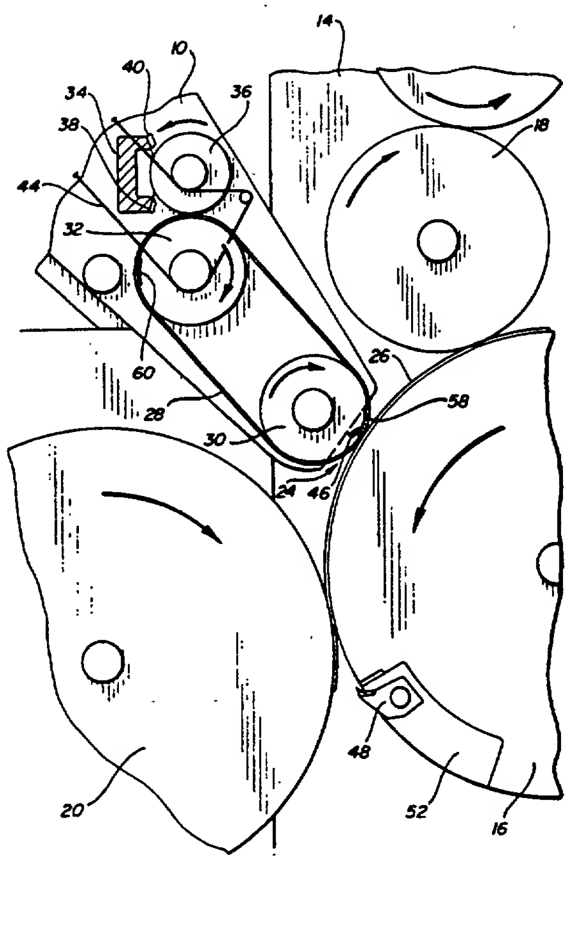
Primary Examiner—W. Gary Jones
Assistant Examiner—Todd J. Burns
Attorney, Agent, or Firm—Hoffmann & Baron

[57] **ABSTRACT**

A liquid coating apparatus capable of applying a liquid coating fluid to a workpiece traveling over a press cylinder rotatably mounted in a printing press is provided. The coating apparatus includes an applicator means which communicates with the press cylinder to form a nip site when the coating apparatus is in a operative position. The applicator means transfers the liquid coating fluid from the coating apparatus to a workpiece that has been caused to travel through the nip site. The applicator means includes an endless coating plate belt driveably mounted upon two support rollers, thereby affording communication of the endless coating plate belt with a press cylinder which has limited access to its surface.

16 Claims, 4 Drawing Sheets



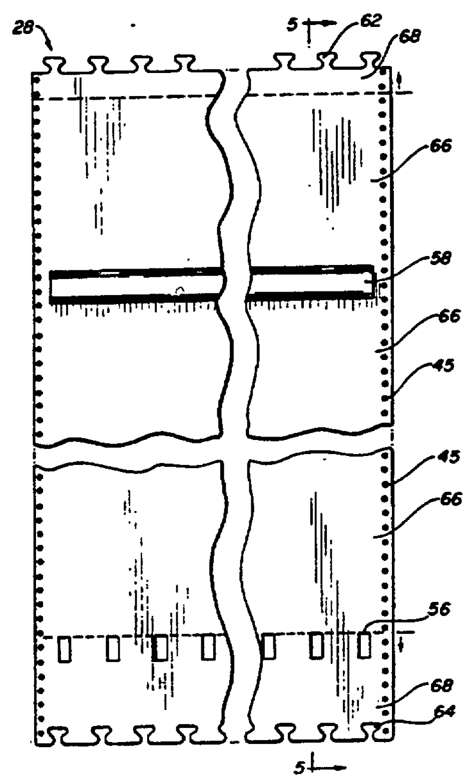


FIG-1

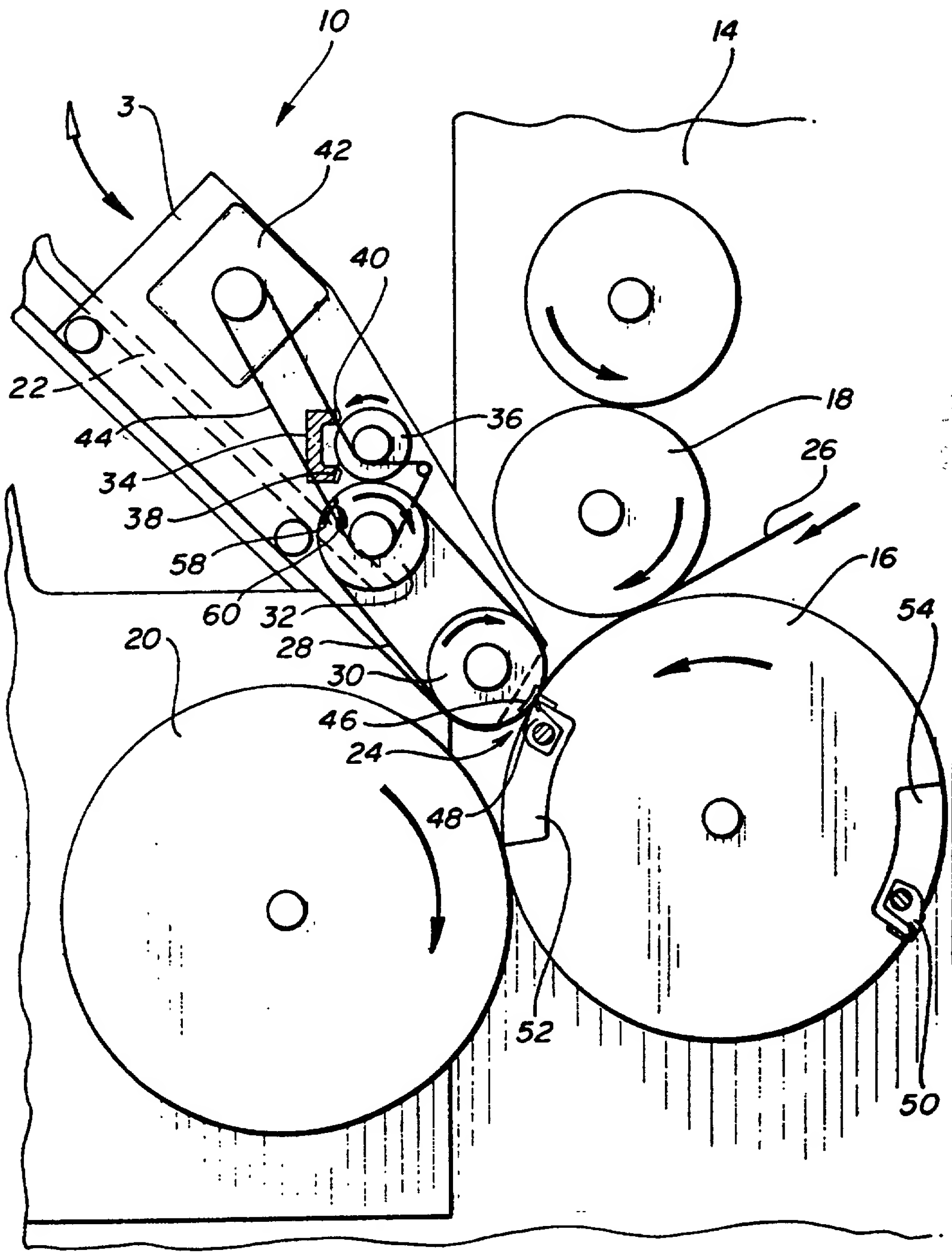


FIG-2

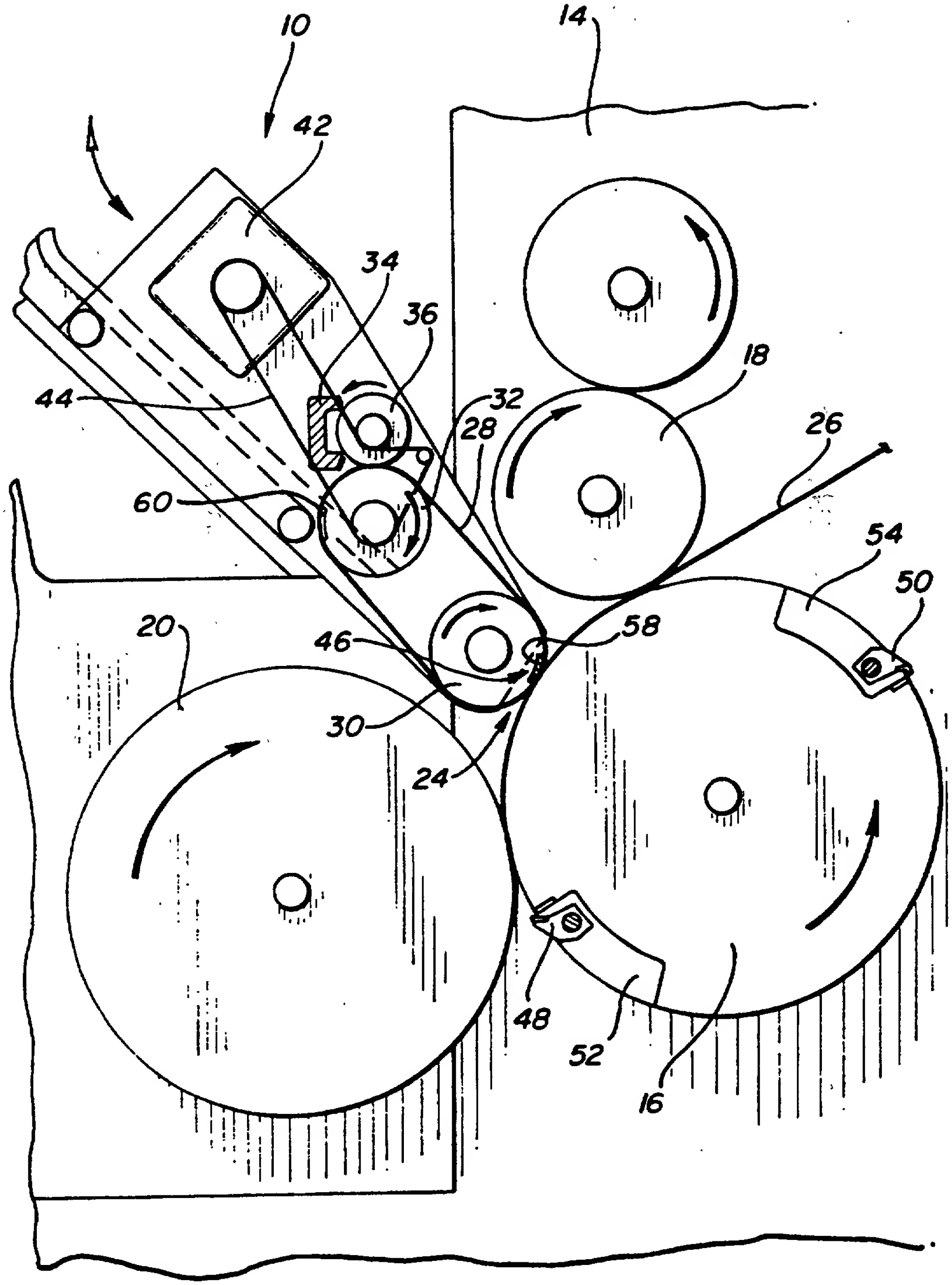


FIG-3

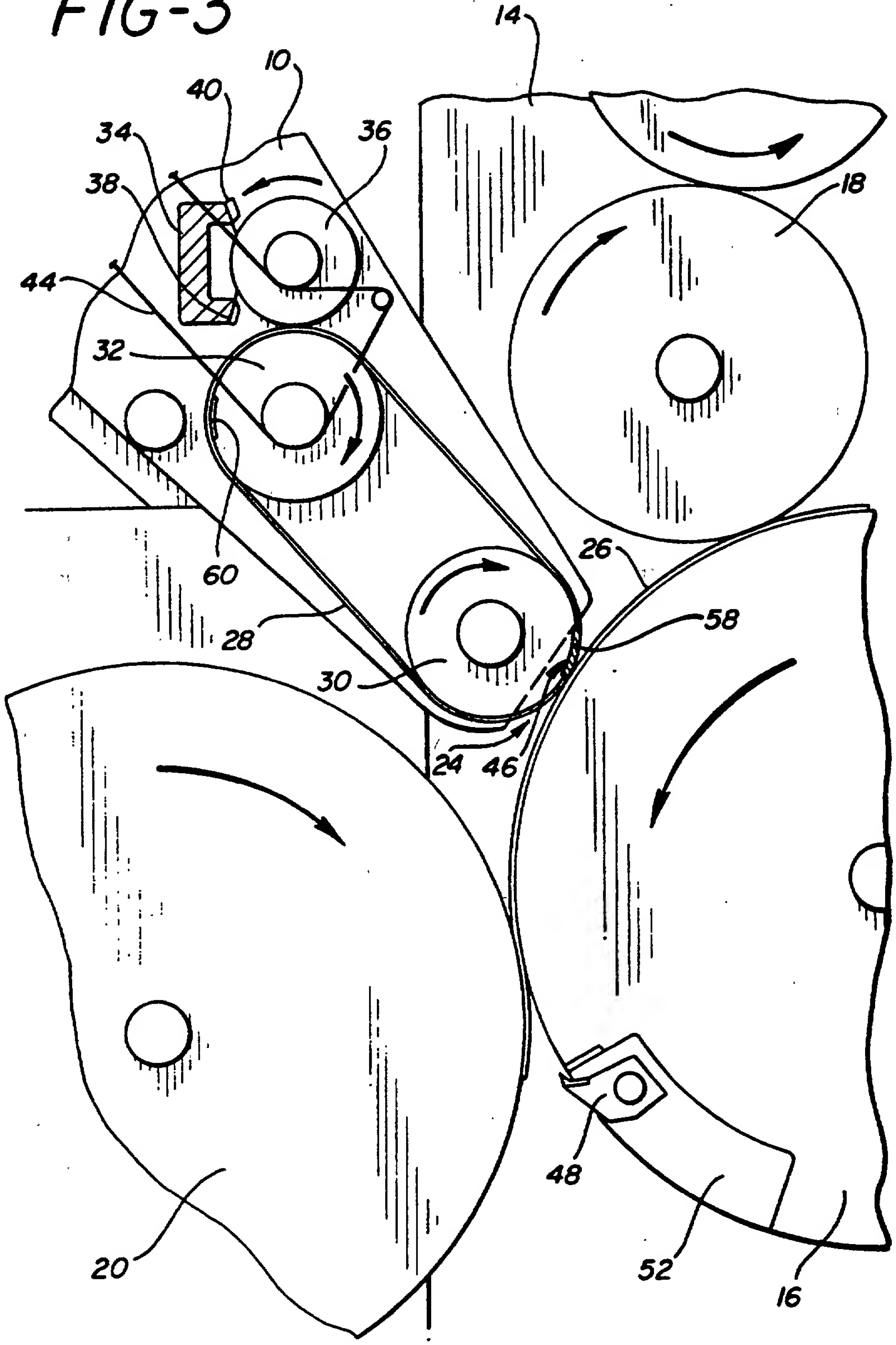


FIG-4

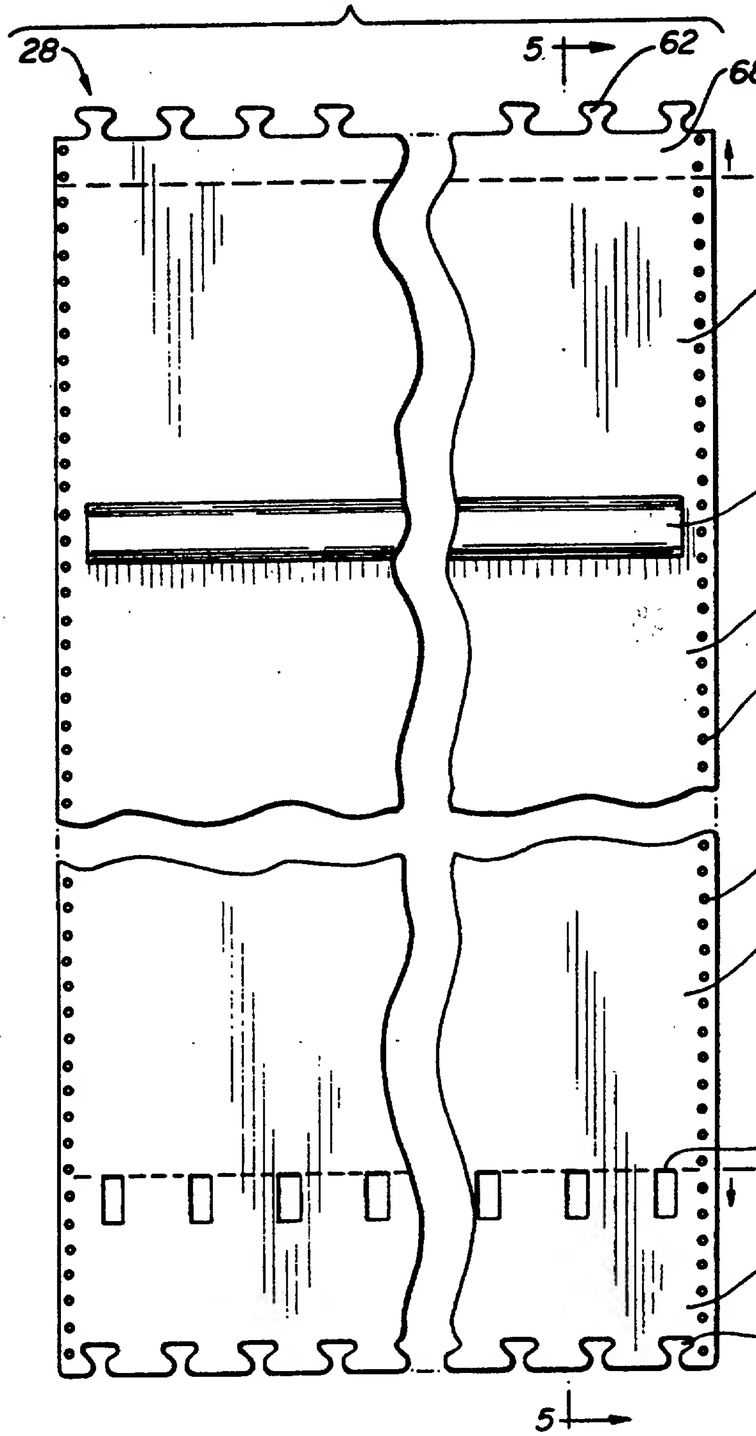
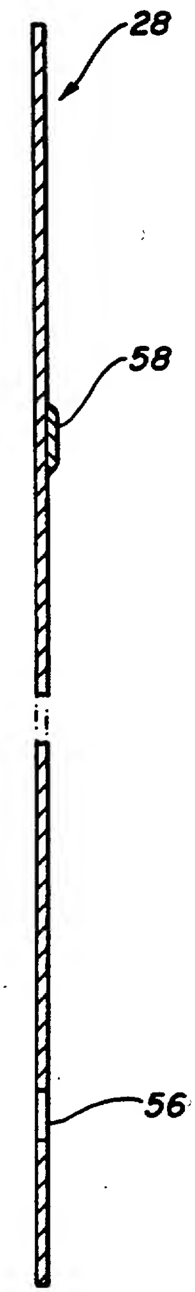


FIG-5



LIQUID COATING APPARATUS FOR USE IN CONJUNCTION WITH PRINTING PRESSES WHERE ACCESS OF THE COATING APPARATUS TO THE PRESS CYLINDERS IS RESTRICTED

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to the printing industry and in particular to coating apparatus used in conjunction with printing presses for the application of liquid coating fluid to the surface of a workpiece. In particular, the present invention relates to coating apparatus which apply a liquid coating fluid to a workpiece while the workpiece travels over a press cylinder rotating in a printing press. More particularly, the present invention relates to coating apparatus for applying a liquid coating fluid to a workpiece on a press cylinder where access to the surface of the cylinder is restricted due to the orientation of adjacent cylinders operating in the printing press.

2. Description of the Prior Art

In many situations in the printing industry, it is desirable to apply a liquid coating fluid to the surface of a workpiece as it travels through a printing press. In order to achieve this objective, it is necessary to position a coating apparatus in sufficient proximity to the printing press so that the applicator means of the coating apparatus can contact the workpiece and apply the coating fluid as the workpiece moves over one of the press cylinders. Once the applicator means comes in contact with the press cylinder, a "nip" is formed through which the workpiece can travel.

In the printing industry, there are several types of printing presses having press cylinders which are oriented within the press frame in such a manner that access to their surface is limited. Consequently, problems have arisen when artisans have attempted to position a coating apparatus within sufficient proximity to the printing press so that the applicator means of the coating apparatus can form a "nip" with a particular press cylinder in the press.

These problems are mostly due to spacial constraints imposed by other press cylinders which are adjacent to the particular press cylinder sought to be contacted. For example, in one commercially available printing press (manufactured by the Komori Corporation, Tokyo, Japan), the impression cylinder is positioned between a blanket cylinder and a delivery or transfer cylinder in a configuration that severely restricts access to the surface of the impression cylinder. Consequently, existing coating assemblies cannot be used with such presses where contact with the impression cylinder is desired since the diameter of the applicator roller of these assemblies is too large to clear the space between the blanket cylinder and the delivery or transfer cylinder.

It is therefore an object of the present invention to provide for a coating apparatus which can be used in conjunction with a printing press to apply a liquid coating fluid to a workpiece traveling on a press cylinder having restricted access to its surface.

SUMMARY OF THE INVENTION

The present invention is a liquid coating apparatus operable in conjunction with either a sheet-fed or a web-fed printing press and is capable of applying a liquid coating fluid to a workpiece while the workpiece travels over the surface of a press cylinder rotating within the press. The present invention is especially advantageous when attempting to apply coating fluid to a workpiece traveling upon a press cylinder having restricted access to its surface.

The coating apparatus of the present invention includes a driveable support means capable of supporting an endless coating plate belt which functions to transfer liquid coating fluid from the coating apparatus to the workpiece. The coating plate belt is both supported and driven by the driveable support means. The coating apparatus also includes means for driving the driveable support means such that the coating plate belt is caused to be driven about the support means. A supply means is included to supply the liquid coating fluid to the belt while a metering means is employed to meter the supply of liquid coating fluid being supplied to the belt.

For a better understanding of the present invention, together with other and further objects, reference is made to the following description, taken together with the accompanying drawings and its scope will be pointed out in the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view of the coating apparatus of the present invention shown in communication with a sheet-fed printing press.

FIG. 2 is a side elevational view of the coating apparatus of FIG. 1 wherein the coating plate belt is shown at a different point in its rotation about the driveable support means.

FIG. 3 is a side elevational view of the coating apparatus shown in FIG. 2 enlarged to show the nip site present between the coating apparatus and the printing press.

FIG. 4 is a plan view of the coating plate belt of the present invention shown from the backside of the belt.

FIG. 5 is a side elevational view of the coating plate belt of FIG. 4.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT OF THE INVENTION

Referring to FIGS. 1–4, the preferred embodiment of a coating apparatus 10 of the present invention is provided. Referring to FIG. 1, the coating apparatus 10 is shown positioned adjacent to a printing press 14. The printing press 14 includes a printing press cylinder 16 which is typically either a blanket or an impression cylinder. Press cylinder 16 has limited access to its surface due to adjacent press cylinders 18 and 20.

Retraction means 22 is provided for moving the coating apparatus into and out of an adjoining relationship with press cylinder 22 at nip site 24. In the operative position, the coating apparatus forms a "nip" with press cylinder 16 through which a workpiece 26 may pass.

Coating apparatus 10 includes an endless coating plate belt 28 which is supported by and trained about a first roller 30 and a second roller 32, both mounted for rotation within coating apparatus frame 33.

The coating belt 28 delivers liquid coating fluid to workpiece 26 as the workpiece travels through nip site 24 mounted about cylinder 16. Coating fountain 34 supplies liquid coating fluid to anilox roller 36 which, in turn, transfers the coating fluid from the fountain to coating belt 28. Doctor blades 38 and 40 are coupled to coating fountain 34 to meter the supply of coating fluid

transferred to coating belt 28 via anilox roller 36. The liquid coating supply means can be of any suitable type known in the art. Additionally, other methods known in the art for transferring and metering the coating supply to be received by coating belt 28 could alternatively be employed. The combination of an anilox roller and a doctor blade is merely exemplary of one such approach.

As previously mentioned, a first roller 30 and a second roller 32 provide support for coating plate belt 28. Roller 30 is referred to as a pressure roller since it provides the coating plate belt 28 with support at nip site 24, thereby affording sufficient "back pressure" against workpiece 26 as it moves through the nip. Roller 32 is referred to as a transfer roller since it provides the coating belt with support at the point where the coating belt receives coating fluid that has been transferred by anilox roller 36.

Coating plate belt 28 is trained around the pressure and transfer rollers for movement about the rollers. At least one of the rollers is driveably coupled to a motor or some other drive means. In the preferred embodiment of the present invention, transfer roller 32 is driveably coupled to motor 42 by way of drive train belt 44 enabling transfer roller 32 to undergo rotation upon activation of motor 42. Coating belt 28 is driveably coupled to transfer roller 32 such that rotation of the roller drives the coating belt about both pressure roller 30 and transfer roller 32.

In the preferred embodiment of the present invention, pressure roller 30 is not coupled to drive train belt 44, but rather rotates via a drive coupling (not shown) with coating plate belt 28. This drive coupling can be of any suitable type known in the art. For example, FIG. 4 shows coating plate belt 28 having track holes 45. These track holes communicate with sprocket assemblies (not shown) on rollers 30 and 32.

Referring to FIGS. 1–4, transfer roller 32 undergoes rotation via drive train belt 44. A sprocket assembly (not shown) coupled to transfer roller 32 rotates engaging track holes 45 on coating plate belt 28, thereby imparting movement to the coating belt. Consequently, coating plate belt 28 undergoes movement and imparts rotation to pressure roller 30 upon communication of track holes 45 with a sprocket assembly (not shown) coupled to roller 30. Alternatively, drive train belt 44 can be driveably coupled to pressure roller 30, leaving transfer roller 32 to undergo rotation via movement of coating belt 28.

Another drive train configuration (not shown) can also be employed utilizing an auxiliary drive coupling between transfer roller 32 and pressure roller 30. In this configuration, drive train belt 44 is operatively coupled to one of the rollers at one side while the auxiliary drive coupling is coupled to the other side. The auxiliary drive coupling is also coupled to the other roller, thereby imparting rotation to the other roller and alleviating drive stress on the coating plate belt 28.

In the preferred embodiment of the present invention, the rollers of the coating apparatus are driven by an independent drive means, such as motor 42. Alternatively, the rollers of the coating apparatus could be driven by a positive coupling to the printing press drive train, thereby avoiding the need for an independent motor assembly.

Although the present invention is capable of applying liquid coating fluid to a workpiece traveling over a press cylinder in either a web-fed or an individual sheet-fed press, the preferred embodiment shown in FIGS. 1–4 includes structure for operation in conjunction with the latter.

In particular, pressure roller 30 includes a notch or recessed area 46 formed or cut into its surface as shown in FIGS. 1–3. Recessed area 46 should have sufficient dimensions to accommodate the height of gripper 48 and gripper 50 as they pass through the nip site 24.

In sheet-fed printing presses, individual workpieces travel through the press, one sheet at a time. Consequently, press cylinders employed in these presses have "grippers" positioned at various points along their surfaces in order to transfer and guide the individual sheets from cylinder to cylinder. Generally, grippers function by grabbing and retaining the leading edge of an individual sheet until the sheet is subsequently passed to an adjacent cylinder. Each gripper has a series of finger-like projections extending outwardly from and positioned longitudinally along the body of the gripper to perform the "grabbing" and "retaining" function.

A gripper is typically positioned in a cylinder gap or trough so that it does not create an obstruction when the cylinder rotates the gripper into contact with an adjacent cylinder. For example, in FIGS. 1–3, grippers 48 and 50 are shown residing in cylinder gaps 52 and 54, respectively. Although most of the gripper body resides in the recessed cylinder gap, a portion of the gripper fingers extending from each gripper must protrude slightly above the surface of the cylinder on which the gripper is positioned in order to effectively "grab" the leading edge of the sheet. Consequently, there must be a notch or recessed area residing somewhere along a portion of the surface of any cylinder which abuts another cylinder having a gripper. This notch or recessed area must be of sufficient depth to accommodate that portion of the gripper protruding above the surface of the cylinder on which it resides

Generally, impression and transfer cylinders of sheet-fed printing presses are equipped with grippers while any blanket and/or other cylinders which abut impression or other cylinders having grippers include recessed areas in their surfaces to accommodate the grippers.

Referring to FIGS. 1–3, coating plate belt 28 is shown passing between pressure roller 30 and press cylinder 16 in order to transfer the liquid coating fluid to workpiece 26 as it passes through the nip site 24. Referring briefly to FIG. 4, coating plate belt 28 includes gripper slots 56 formed through the thickness of the belt and positioned across the width of the belt. When coating belt 28 is initially mounted about rollers 30 and 32, it should be oriented so as to align the gripper slots 56 over the recessed area 46 of the pressure roller 30.

Furthermore, the orientation of the coating plate belt about rollers 30 and 32 should be such that the gripper slots 56 are aligned over recessed area 46 at a preselected angular rotational position of pressure roller 30. More particularly, gripper slots 56 should pass through nip site 24 simultaneously and in alignment with recessed area 46 so as to accommodate the height of grippers 48 and 50. Consequently, gripper slots 56 should be of sufficient number and should have dimensions for accommodating the gripper-fingers (not shown) of grippers 48 and 50. Insufficient slot size or misalignment of the slots and recessed area 46 may damage the coating plate belt or the grippers.

In addition to providing for an alignment of gripper slots 56 with recessed area 46 on pressure roller 30 in order to accommodate any grippers which may be pres-

ent on press cylinder **16**, coating plate belt **28** must be sized in accordance with the press cylinder to which it abuts to form a nip when the coating apparatus is being used in conjunction with a sheet-fed press or during spot-coating operations performed on either a sheet-fed or web-fed press.

For example, in a sheet-fed printing press, individual sheets are transferred from press cylinder to press cylinder as they move through the press. As previously mentioned, these individual sheets or workpieces are often retained on the surface of these cylinders by grippers which grab the leading edge of the workpiece. The number of sheets that can be retained on the surface of any one cylinder at any one instant in time depends upon the number of grippers available on the cylinder, the circumferential diameter available on the cylinder surface against which the sheets are supported and the length of the individual sheets. Cylinder gaps recessed in the surface of these cylinders for housing the grippers do not provide for a supporting surface against which a workpiece can rest and consequently result in what is referred to as "dead space" on the cylinder surface.

For example, the area of a press cylinder surface between the trailing edge of one workpiece and the leading edge of another workpiece would constitute "dead space". Obviously, in coating operations where the coating apparatus is contacting a press cylinder to deliver coating fluid to a workpiece, it would be undesirable to have the coating plate belt deliver coating fluid to the nip when there is no workpiece present to receive the coating fluid.

Consequently, when the coating apparatus of the present invention is used in conjunction with a sheet-fed printing press or in spot coating operations, the coating plate belt must be sized in order to accommodate individual sheet length as well as individual sheet width. Additionally, the belt length must also include "no print" areas where coating fluid is absent from the belt. These "no print" areas must be coordinated with "dead space" present on the press cylinder.

Accordingly, the length of the coating plate belt of the present invention is either equivalent to or an inverse multiple of the circumferential measurement of the press cylinder to which it abuts. For example, in the preferred embodiment of the present invention, coating plate belt **28** has a length which is one half the circumferential measurement of press cylinder **16**. Consequently, for every complete rotation of press cylinder **16**, coating belt **28** makes two complete revolutions around rollers **30** and **32**.

Alternatively, in overall coating or full-coverage coating operations performed on a web-fed press, a continuous web of material receives a uniform, unbroken application of coating fluid. Consequently, if the present invention were to be employed in such a procedure, considerations regarding belt length and the strategic positioning of "no print" regions along the length of the belt would be of minor concern.

Referring to FIG. **1**, workpiece **26** is shown with its leading edge held in position at nip site **24** by gripper **48**. Recessed area **46** is present at the nip site to accommodate the portion of gripper **48** which extends above the surface of press cylinder **16**. As previously mentioned, it is necessary to have the recessed area **46** positioned in the nip site simultaneously with the gripper in order to prevent damage to the equipment.

Additionally, the circumferential measurement of pressure roller **30** must be an inverse multiple of the circumferential measurement of press cylinder **16**. By way of illustration, if pressure roller **30** has a circumferential measurement equivalent to the circumferential measurement of press cylinder **16**, pressure roller **30** would require a number of recessed areas on its surface equal to the number of grippers on press cylinder **16**. Furthermore, each of the recessed areas must be of sufficient depth to accommodate that portion of each gripper finger which extends from the body of each gripper and protrudes above the press cylinder surface.

Such a situation would be impossible however, due to the presence of press cylinders **18** and **20**, which severely limit accessibility to the surface of press cylinder **16**. Consequently, the circumferential measurement of pressure roller **30** cannot be equivalent to the circumferential measurement of press cylinder **16**, but rather must be sufficiently reduced in order to access the cylinder surface.

Since pressure roller **30** will have a smaller circumferential measurement than press cylinder **16**, it will rotate a number of times for every single rotation of press cylinder **16** in order to maintain the same surface speed. If press cylinder **16** has grippers present on its surface, pressure roller **30** will have to have a circumferential measurement which is an inverse multiple of the circumferential measurement of press cylinder **16** in order to have recessed area **46** present at nip site **24** when a gripper passes through the nip.

In a typical coating apparatus used in conjunction with a sheet-fed printing press, an applicator roller on the coater transfers the coating fluid to the printing press. In particular, the applicator roller either transfers the coating fluid directly to the workpiece as it moves through the nip site created between a printing press cylinder and the coating apparatus applicator roller or the applicator roller transfers the coating fluid to a blanket cylinder which, in turn, applies the coating fluid to the workpiece.

In either situation, the applicator roller will repeatedly apply coating fluid directly or indirectly to individual worksheets as they pass through the nip. Consequently, the applicator roller must have a circumferential measurement at least equivalent to sheet length in order to ensure image repeatability. Furthermore, the circumferential measurement of the applicator roller must actually be greater than the individual sheet length so that the "dead space" present on the press cylinder surface between the trailing edge of one sheet and the leading edge of the next sheet does not receive any coating fluid.

Due to the spacial constraints present in many printing press arrangements, a coating apparatus having an applicator roller conforming to even these minimal circumferential measurement parameters has a diameter which precludes it from abutting the desired press cylinder within the printing press in order to deliver a liquid coating fluid to a workpiece traveling thereon.

Consequently, in the preferred embodiment of the present invention, the coating plate belt **28** should be of sufficient length to accommodate a coating surface equivalent to the individual sheet length of workpiece **26** plus any additional length needed to provide for a "no print" region corresponding to the "dead space" on the press cylinder.

In short, the length of coating plate belt **28** should be proportional to the circumferential measurement of press cylinder **16**. As previously mentioned, these considerations apply when the present invention is being

used in conjunction with a sheet-fed press or in a spot coating procedure done on either a sheet-fed or web-fed press. For spot coating procedures performed on a web-fed press, the belt length must be sized so as to incorporate "no print" regions despite the fact that no grippers or cylinder gaps are present. In contrast, overall coating procedures performed on a web-fed press do not require that the length of the coating plate belt be sized to account for the presence of "no print" regions since the coating fluid is continuously being applied.

The diameter of pressure roller 30 should be sufficiently reduced so as to afford clearance between press cylinders 18 and 20 while providing for contact of the coating belt with press cylinder 16. As previously mentioned, the circumferential measurement of pressure roller 30 should be an inverse multiple of the circumferential measurement of press cylinder 16 in order to ensure that the recessed area 46 is always present at the nip site whenever a gripper on press cylinder 16 passes through the nip.

In the preferred embodiment of the present invention, pressure roller 30 has, for example, a circumferential measurement which is ¼ the circumferential measurement of press cylinder 16. Consequently, for every complete rotation of press cylinder 16, pressure roller 30 makes four complete revolutions. Furthermore, recessed area 46 passes through nip site 24 four times, twice for every passage of a gripper through the nip. As a result, recessed area 46 only accommodates a gripper at nip site 24 during every other passage through the nip.

For example, referring to FIGS. 2 and 3, recessed area 46 is shown in a position just prior to entering nip site 24. Referring in particular to FIG. 2, grippers 48 and 50 are shown in their respective positions approximately 90° away from the nip site.

As previously explained, coating plate belt 28 must be of a length proportional to the circumferential measurement of press cylinder 16 and pressure roller 30 must be an inverse multiple of the circumferential measurement of press cylinder 16. Consequently, the length of coating plate belt 28 will be proportional to the circumferential measurement of pressure roller 30, by necessity.

This relationship is important. During every other passage of recessed area 46 through nip site 24, coating plate belt 28 is applying coating fluid to workpiece 26, as seen in FIG. 3. In order for the coating fluid to be uniformly applied to the surface of the workpiece, pressure roller 30 must apply sufficient back pressure to coating belt 28 at nip site 24.

In order to maintain this back pressure on the coating belt at the nip site during every other passage of recessed area 46 through the nip, a filler piece or strip 58 is mounted across the width of the coating belt as seen in FIG. 4. The filler piece is mounted on the backside of the coating belt which contacts rollers 30 and 32. Filler piece 58 should have dimensions approximating the dimensions of recessed area 46 so as to cooperatively mate with the recess. Similarly, recessed area 46 should have dimensions which can accommodate filler piece 58.

As previously explained with respect to the preferred embodiment of the present invention, press cylinder 16 makes one complete revolution for every four complete revolutions of pressure roller 30. Furthermore, recessed area 46 will pass through the nip site four times for every complete revolution of press cylinder 16. In two of these passes through the nip site, a gripper on press cylinder 16 will be present at the nip to meet the recessed area. In the other two passes through the nip site, no gripper will be present to meet the recessed area, however, the filler piece on the backside of the coating belt will move into recessed area to provide back pressure for the coating belt which is simultaneously delivering coating fluid to the workpiece in the nip.

Since the filler piece 58 is affixed to the backside of coating plate belt 28, its presence must be accommodated on transfer roller 32 as well. Consequently, transfer roller 32 has a secondary recessed area 60 on its surface. Secondary recessed area 60 also has dimensions which approximate the dimensions of filler piece 58 so as to accommodate the presence of the filler piece when it contacts the roller surface.

Referring to FIG. 4, coating plate belt 28 is shown in a plan view from the backside of the belt. The coating plate belt includes splicing patterns 62 and 64 which consists of cooperating mechanical segments which can interlock with one another in order to position the belt about rollers 30 and 32. The coating plate belt includes printing region 66 and no print region 68. Printing region 66 is available for delivering coating fluid to a workpiece as it passes through the nip site. Accordingly, coating plate belt 28 must be oriented about rollers 30 and 32 in such a fashion as to coordinate the passage of printing region 66 through the nip site with those areas on the surface of press cylinder 16 which do not constitute "dead space". No print region 68 includes gripper slots 56. This region of coating plate belt 28 must similarly be coordinated with the surface of press cylinder 16, however, it should be coordinated so as to pass through the nip site simultaneously with the "dead space" (not shown) present on press cylinder 16.

The coating plate belt of the present invention is interchangeable with other coating belts depending upon the coating operation to be performed. In overall coating operations where the workpiece receives full coverage of the coating fluid, the coating plate belt need only be changed depending upon the dimensions of the workpiece to be covered or the type of coating fluid to be applied. In spot coating operations, however, the coating plate belt should obviously be changed in accordance with designated areas on the workpiece which are to receive the coating fluid.

In operation, anilox roller 36 picks up coating fluid from coating fountain 34. Doctor blades 38 and 40 meter the supply of coating fluid on the anilox roller before the fluid is transferred to coating plate belt 28. Anilox roller 36 subsequently transfers the metered supply of coating fluid to coating plate belt 28 which is driven about rollers 30 and 32. Referring to FIG. 1, a workpiece 26 is shown partially positioned on press cylinder 16 with its leading edge held by gripper 48. Recessed area 46 is present to accommodate gripper 48 and the no print region 68 (not shown) of the belt is present in nip site 24 to correspond with the presence of "dead space" (not shown) on press cylinder 16. Filler piece 58 is shown positioned in contact with transfer roller 32 and residing in secondary recessed area 60.

As the workpiece moves through the nip, printing region 66 (not shown) of plate coating belt 28 applies the coating fluid to workpiece 26 at the nip site. Referring to FIG. 3, workpiece 26 is shown positioned well into the nip. Additionally, recessed area 46 on pressure roller 30 is about to enter the nip site 24. Filler piece 58 is shown residing in recessed area 46 in order to provide sufficient back pressure for coating plate belt 28 which

is applying coating fluid (not shown) to the workpiece. Secondary recessed area **60** on transfer cylinder **32** is shown vacant as filler piece **58** is residing in recessed area **46**.

While there have been described what are presently believed to be the preferred embodiments of the invention disclosed herein, those skilled in the art will realize that changes and modifications may be made thereto without departing from spirit of the invention, and it is intended to claim all such changes and modifications as fall within the true scope of the invention.

What is claimed is:

1. A liquid coating apparatus capable of operating in conjunction with a printing press having at least one press cylinder, the cylinder rotatably mounted within the press and having at least one gripper mechanism, the apparatus capable of applying a liquid coating fluid to a workpiece traveling over the press cylinder and comprising:

a driveable support means suitable for supporting a belt, the support means including a first and a second roller both rotatably mounted within the apparatus, at least one of the rollers being drivingly coupled to a drive means;

an endless coating plate belt for transferring the liquid coating fluid from the coating apparatus to the workpiece, the endless coating plate being trained about the first and second rollers and driveable by the rollers and supported thereon, the belt including at least three openings distributed transversely across the width of the belt;

drive means for driving the support means, thereby causing the endless coating plate belt to be driven about the first and second rollers;

supply means for supplying the liquid coating fluid to the endless coating plate belt; and

metering means for metering the supply of liquid coating fluid supplied to the endless coating plate belt.

2. The liquid coating apparatus according to claim **1**, wherein the first roller includes at least one recessed area present on the surface of the first roller and wherein the at least three openings are gripper slots formed through the thickness of the endless coating plate belt, the gripper slots being positionally aligned over the recessed area on the surface of the first roller at a selected angular rotational position of the first roller.

3. The liquid coating apparatus according to claim **2**, wherein the endless coating plate belt includes a filler piece having dimensions approximating the dimensions of the recessed area on the surface of the first roller, the filler piece being oriented on the endless coating plate belt so as to afford a cooperative communication of the filler piece with the recessed area on the surface of the first roller upon contact of the filler piece with the first roller and wherein the second roller includes a recessed area on its surface having suitable dimensions for accommodation of the filler piece in a cooperative relationship upon contact of the filler piece with the second roller.

4. The liquid coating apparatus according to claim **2**, wherein the first roller has a circumferential measurement which is an inverse multiple of the circumferential measurement of the press cylinder.

5. The liquid coating apparatus according to claim **4**, wherein the first roller has a circumferential measurement which is one-fourth the circumferential of the press cylinder.

6. The liquid coating apparatus according to claim **1**, wherein the endless coating plate belt has a length equivalent to the circumferential measurement of the press cylinder.

7. The liquid coating apparatus according to claim **1**, wherein the endless coating plate belt has a length which is an inverse multiple of the circumferential measurement of the press cylinder.

8. The liquid coating apparatus according to claim **7**, wherein the endless coating plate belt has a length which is one-half the circumferential measurement of the press cylinder.

9. An assembly including a printing press, a coating apparatus capable of operating in conjunction with the printing press and means for moving the coating apparatus into an adjoining relationship with the press so as to form a nip site through which workpieces can travel, the printing press having at least one press cylinder rotatably mounted within the press, the coating apparatus being capable of applying a liquid coating fluid to a workpiece traveling over the press cylinder, the coating apparatus comprising:

a driveable support means suitable for supporting a belt, the support means including a first and a second roller both rotatably mounted within the apparatus, at least one of the rollers being drivingly coupled to a drive means;

an endless coating plate belt for transferring the liquid coating fluid from the coating apparatus to the workpiece at the nip site, the endless coating plate belt being trained about the first and second rollers and driveable by the rollers and supported thereon, the belt including at least one opening formed therein, the opening configured and dimensioned to accommodate passage of the gripper mechanism therethrough;

drive means for driving the support means, thereby causing the endless coating plate belt to be driven about the first and second rollers;

supply means for supplying the liquid coating fluid to the endless coating plate belt; and

metering means for metering the supply of liquid coating fluid supplied to the endless coating plate belt.

10. The assembly according to claim **9**, wherein the first roller includes at least one recessed area present on the surface of the first roller and wherein the at least one opening is a gripper slot formed through the thickness of the endless coating plate belt, the gripper slot being positionally aligned over the recessed area on the surface of the first roller at a selected angular rotational position of the roller.

11. The assembly according to claim **10**, wherein the endless coating plate belt of the coating apparatus includes a filler piece having dimensions approximating the dimensions of the recessed area on the surface of the first roller, the filler piece being oriented on the endless coating plate belt so as to afford a cooperative communication of the filler piece with the recessed area on the surface of the first roller upon contact of the filler piece with the first roller and wherein the second roller includes a recessed area on its surface having suitable dimensions for accommodation of the filler piece in a cooperative relationship upon contact of the filler piece with the second roller.

12. The assembly according to claim **10**, wherein the first roller has a circumferentially measurement which

is an inverse multiple of the circumferential measurement of the press cylinder.

13. The assembly according to claim 12, wherein the first roller has a circumferential measurement which is one fourth the circumferential measurement of the press cylinder.

14. The assembly according to claim 9, wherein the endless coating plate belt of the coating apparatus has a length equivalent to the circumferential measurement of the press cylinder.

15. The assembly according to claim 9, wherein the endless coating plate belt of the coating apparatus has a length which is an inverse multiple of the circumferential measurement of the press cylinder.

16. The assembly according to claim 15, wherein the endless coating plate belt of the coating apparatus has a length which is one half the circumferential measurement of the press cylinder.

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(71) Applicant: **DeMoore, Howard W.**
10954 Shady Trail
Dallas,
Texas 75220 (US)

(72) Inventor: **Demoore, Howard Warren**
10954 Shady Trail
Dallas,
Texas 75220 (US)
Inventor: **Secor, Howard Curtis**
421 Hunters Ridge Circle
Coppell,
Texas 75019 (US)

(74) Representative: **Gura, Henry Alan et al**
MEWBURN ELLIS
York House
23 Kingsway
London WC2B 6HP (GB)

(54) High velocity, hot air dryer and extractor.

(57) A hot air dryer (10) utilizes high velocity air jets which scrub and break up the moist air layer which clings to the surface of a freshly printed sheet (S). High velocity air is heated to a high temperature as it flows along a resistance heating element (38) within an air delivery baffle tube (64). The heated, high velocity air pressurizes a plenum chamber (46) within an air distribution manifold (36W). High velocity jets of hot air are discharged through multiple airflow apertures (54) onto the wet ink side of a printed sheet as it moves through a dryer exposure zone (Z). An extractor (40) removes the moist air layer, high velocity hot air and volatiles from the printed sheet (S) and from the press (12).

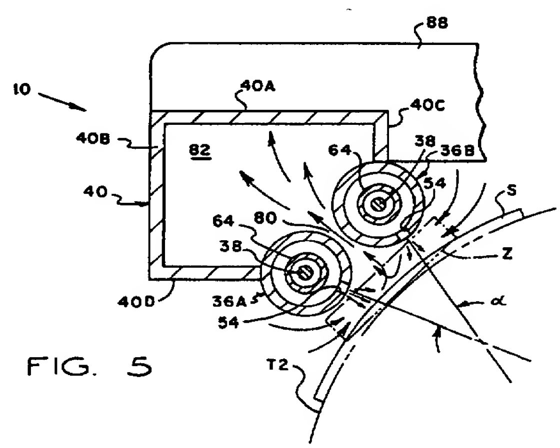

FIG. 5

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This invention relates generally to accessories for sheet-fed, rotary offset and flexographic printing presses, and in particular to a dryer for printed materials which utilizes high velocity, hot air flow and extraction.

In the operation of a rotary offset press, an image is reproduced on a web or sheet of paper or some other printable substrate by a plate cylinder which carries the image, a blanket cylinder which has an ink transfer surface for receiving the inked image, and an impression cylinder which presses the paper against the blanket cylinder so that the inked image is transferred to the paper. In some applications, a protective and/or decorative coating is applied to the surface of the freshly printed sheets. The freshly printed sheets are then transported to a sheet delivery stacker in which the printed sheets are collected and stacked.

The relatively wet condition of the printing ink composition and its solvent and/or diluent components and a layer of moisture laden air which clings to the surface of the freshly printed web or sheet may interfere with the quality of the images as they are printed at each succeeding printing unit. For example, the quality of colored images, half-tone illustrations and the like undergo degradation in the uniformity of their appearance and color because of the presence of the wet ink, volatiles, and moisture within the printed substrate. Moreover, protective coatings will undergo dilution and surface degradation causing a dull finish if the underlying substrate is not dried sufficiently before the coating is applied.

Such defects, including uneven surface appearance of protective/decorative coatings, detract from the appearance of the underlying images or photographs, particularly in the case of multi-colored images or photographs. The defects are caused by residual volatile solvents, diluents, water and the like within the oleoresinous inks of the images, and the presence of moisture in the printed material, at the time that the next successive image is printed or the protective/decorative coating is applied. Because the defects are compounded as the printed material moves through successive printing units, it is desirable that curing and drying be initiated and volatiles and moisture laden air be extracted at each interstation position, as well as at the delivery position.

Hot air dryers and radiant heaters have been used as delivery dryers and as interstation dryers. Interstation dryers employing radiant heat lamps are best suited for slow to moderate press speeds in which the exposure time of each printed sheet to the radiant heat is long enough to initiate ink setting. For high speed press operation, for example, at 5,000 sheets or more per hour, there is not enough available space at the interstation position to install a radiant heater having sufficient number of heat lamps for adequate drying purposes.

As press speed is increased, the exposure time (the length of time that a printed sheet is exposed to the radiant heat) is reduced. Since the number of lamps is limited by the available interstation space, the output power of the radiant lamps has been increased to deliver more radiant energy at higher temperatures to the printed sheets in an effort to compensate for the reduction in exposure time. The increased operating temperatures of the high-powered radiant heat lamps cause significant heat transfer to the associated printing unit and other equipment mounted on the press frame, accelerated wear of bearings and alterations in the viscosities of the ink and coating, as well as upsetting the balance between dampening solution and ink. The heat build-up may also cause operator discomfort and injury.

To handle high speed press operations, an off-press heater has been utilized from which high velocity, heated air is conveyed through a thermally insulated supply duct to a discharge plenum which directs high velocity, heated air onto the printed stock as it moves across the interstation dryer position. Such off-press heaters have proven to be relatively inefficient because of excessive heat loss and pressure drop along the supply duct. Attempts to overcome the heat loss and pressure drop have resulted in substantially increased physical size of the heater equipment (blower fan and supply duct) along with a substantial increase in the electrical power dissipated by the off-press heater.

According to the present invention, a high efficiency hot air dryer utilizes an on-press heater for producing high velocity hot air flow for accelerating the setting of inks on a freshly printed substrate. The on-press heater includes a housing member having a sidewall defining a manifold air distribution or plenum chamber, with the sidewall being intersected by an airflow discharge port. An air delivery tube has an inlet port for receiving high velocity airflow and has a tubular sidewall disposed in the plenum chamber. An elongated heating element is disposed within the inner airflow passage of the air delivery tube. High velocity air is discharged into the air delivery tube in heat transfer contact along the length of the heating element.

Heated, high velocity air is discharged out of the air delivery tube into the plenum chamber of the housing member. Preferably, the high velocity air is supplied to the manifold plenum chamber through an inlet port having an inlet flow area which is greater than the outlet flow area of the hot air discharge port. By this arrangement, heated air will be supplied to the plenum chamber faster than it can be discharged, so that the heated air will be

compressed within the manifold plenum chamber. This assures that jets of hot air which are discharged through multiple outlet apertures are uniform in pressure and velocity along the length of the dryer head, so that the printed sheet is dried uniformly as it is transferred through the exposure zone of the dryer.

According to another aspect of the present invention, the moist air layer is displaced from the surface of the printed sheet by high-velocity hot air jets which scrub and break-up the moisture-laden air layer that adheres to the printed surface of the sheet. The high-velocity hot air jets create turbulence which overcomes the surface tension of the moisture and separates the moisture laden air from the surface of the printed material. The moisture vapor and volatiles become entrained in the forced air flow and are removed from the printing unit by a high volume extractor.

The scrubbing action of the high velocity hot air jets is improved by adjacent rows of multiple discharge apertures which are oriented to deliver a converging pattern of high velocity hot air jets into an exposure zone across the sheet travel path. The high velocity hot air jets are produced by a pair of elongated dryer heads in which high velocity air is heated by heat transfer contact with a resistance heating element within an air delivery baffle tube. Since the release of moisture and other volatiles from the ink and printed material occurs continuously in response to the absorption of thermal energy, the moisture laden air layer is displaced continuously from the printed sheet as the printed sheet travels through the dryer exposure zone in contact with the converging hot air jets.

According to another aspect of the invention, the moisture-laden air, volatiles and hot air completely exhausted from the printing unit by a high volume extractor. An extractor manifold is coupled to a pair of elongated dryer heads and draws the moisture-laden air, volatiles and high velocity hot air from the exposure zone through a longitudinal air gap between the dryer heads. According to this arrangement, the setting of ink on each printed sheet is initiated and accelerated before the sheet is run through the next printing unit.

Operational features and advantages of the present invention will be understood by those skilled in the art upon reading the detailed description which follows with reference to the attached drawings, wherein:

FIGURE 1 is a schematic side elevational view in which multiple dryers of the present invention are installed at interstation positions in a four color offset rotary printing press;

FIGURE 2 is a simplified side elevational view showing the dryer of the present invention installed in an interstation position between two printing units of FIGURE 1;

FIGURE 3 is a bottom plan view showing installation of the dryer assembly of FIGURE 2 in the interstation position;

FIGURE 4 is a perspective view of the interstation dryer shown in FIGURE 2;

FIGURE 5 is a sectional view of the improved dryer of the present invention taken along the line 5-5 of FIGURE 4;

FIGURE 6 is a longitudinal sectional view of the dryer assembly shown in FIGURE 2;

FIGURE 7 is a sectional view of the dryer assembly shown in FIGURE 2, taken along the line 7-7 of FIGURE 6;

FIGURE 8 is a perspective view of a resistance heating element used in the dryer of FIGURE 2;

FIGURE 9 is a perspective view similar to FIGURE 8, with the resistance heating element enclosed in a support sheath;

FIGURE 10 is a view similar to FIGURE 4 which illustrates an alternative embodiment of the dryer head in which the discharge port is formed by an elongated slot; and,

FIGURE 11 is a perspective view, partially broken away, of the dryer head shown in FIGURE 10.

As used herein, the term "processed" refers to various printing processes which may be applied to either side of a sheet, including the application of inks and/or coatings. The term "substrate" refers to sheet material or web material.

Referring now to FIGURE 1, the high velocity hot air dryer 10 of the present invention will be described as used for drying freshly printed substrates, which are successively printed at multiple printing units in a sheet-fed, rotary offset printing press. In the exemplary embodiment, the dryer 10 of the present invention is installed at an interstation position between two printing units of a four color printing press 12 which is capable of handling individual printed sheets having a width of the approximately 40" (102 millimeters) and capable of printing 10,000 sheets per hour or more, such as that manufactured by Heidelberg Druckmaschinen AG of Germany under its designation Heidelberg Speedmaster 102V.

The press 12 includes a press frame 14 coupled on the right end to a sheet feeder 16 from which sheets, herein designated S, are individually and sequentially fed into the press, and at the opposite end, with a sheet stacker 18 in which the printed sheets are collected and stacked. Interposed between the sheet feeder 16 and the sheet stacker 18 are four substantially identical sheet printing units 20A, 20B, 20C and 20D which can print different color inks onto the sheets as they are moved through the press.

As illustrated in FIGURE 1, each sheet fed printing unit is of conventional design, each unit including a plate cylinder 22, a blanket cylinder 24 and an impression cylinder 26. Freshly printed sheets S from the impression cylinder 26 are transferred to the next printing unit by transfer cylinders T1, T2, T3. A protective coating may be applied to the printed sheets by a coating unit 28 which is positioned adjacent to the last printing unit 20D.

The freshly printed and coated sheets S are transported to the sheet stacker 18 by a delivery conveyor system, generally designated 30. The delivery conveyor 30 is of conventional design and includes a pair of endless delivery gripper chains 32 carrying laterally disposed gripper bars having a gripper element for gripping the leading edge of a freshly printed sheet S as it leaves the impression cylinder 26. As the leading edge of the printed sheet S is gripped by the grippers, the delivery chains 32 pull the gripper bar and sheet S away from the impression cylinder 26 and transports the freshly printed and/or coated sheet to the sheet stacker 18.

Prior to delivery, the freshly printed sheets S pass through a delivery dryer 34 which includes a combination of infra-red thermal radiation, forced air flow and extraction.

Referring now to FIGURE 2, FIGURE 5 and FIGURE 6, the interstation dryer 10 includes as its principal components a dryer head 36, a resistance heating element 38, and an extractor head 40. As shown in FIGURE 3, the dryer head 36 is mounted on the press side frame members 14A, 14B by side frame flanges 42, 44. In this interstation position, the dryer head 36 is extended laterally across and radially spaced from the interstation transfer cylinder T2, thereby defining an exposure zone Z.

The dryer head 36 includes a tubular sidewall 36W which encloses an air distribution manifold chamber 46. The air distribution manifold housing is sealed on opposite ends by end plates 48, 50, respectively, and is sealed against the extractor head 40. The manifold housing has an inlet port 52 for admitting high velocity, pressurized air through a supply duct 52 from an off-press compressor 53, and has a discharge port for delivering pressurized hot air into the exposure zone Z.

As shown in FIGURE 6, the air distribution manifold sidewall 36W is intersected by multiple discharge apertures 54 which collectively define the discharge port. The apertures 54 are oriented for discharging pressurized jets of high velocity, hot air toward the interstation transfer cylinder T2, and are longitudinally spaced along the dryer head 36. According to this arrangement, pressurized air jets are directed along a straight line across the printed side of a sheet S as it moves through the dryer exposure zone Z. In an alternative embodiment, as shown in FIGURE 10 and FIGURE 11, the discharge port is formed by an elongated slot 55 which intersects the dryer head sidewall 36W and extends longitudinally along the dryer head.

Referring now to FIGURE 6 and FIGURE 7, the resistance heating element 38 is coupled to the dryer head 36 by and end block 56. The end block 56 has a body portion which is intersected by an axial bore 58, a counterbore 60 and a radial inlet bore 62 which communicates with the counterbore. The heating element 38 has an end portion 38A which projects through the axial bore 58 and counterbore 60, with the elongated body portion of the heating element 38 extending into the plenum chamber 46.

According to an important feature of the present invention, the plenum chamber 46 is partitioned by an elongated air delivery baffle tube 64 which extends substantially the entire length of the dryer head 36. The air delivery baffle tube 64 has an inlet port 66 for receiving high velocity airflow from a remote supply and has a tubular sidewall 64A extending through the plenum chamber. The tubular sidewall 64A has an inner airflow passage 68 which connects the inlet port 66 in airflow communication with the plenum chamber 46 through its open end 64E. The air delivery baffle tube 64 has an end portion 64B projecting through the axial bore 60 of the end block 56, with its inner airflow passage 66 in airflow registration with the radial bore 62.

A pneumatic connector 70 is coupled to the radial inlet bore 62 of the end block 56 for connecting the inner airflow passage 68 to an off-press source of high velocity air. The end block 56 is sealed against the end plate 50, the tubular sheath 78 and against the pneumatic connector 70. High velocity, pressurized air is constrained to flow from the air duct 52 into the airflow passage 68 where it is discharged into the air distribution plenum chamber 46 after absorbing heat from the heating element 38.

As shown in FIGURE 6, the high velocity air flows longitudinally through the annular flow passage 68 in heat transfer contact with the heating element 38. The high velocity air is heated to a high temperature, for example 350 °F (176 °C), before it is discharged through the airflow apertures 54.

To provide uniform air jet discharge through the apertures 54, the inlet area of the inlet port 66 should be greater than the combined outlet area provided by the multiple airflow discharge apertures 54. In the preferred embodiment, the discharge apertures 54 have a diameter of 1/16 inch (0.158 cm), and for a 40" (102 mm) press there are 88 apertures spaced apart along the dryer head 36 on 0.446 inch (1.13 cm) centers. This yields a total

airflow outlet area of 0.269 square inch (1.735 square cm). Preferably, the effective inlet area of the inlet port 66 is at least about 0.54 square inch (3.484 square cm).

In the alternative dryer head embodiment shown in FIGURE 10, the air discharge slot 55 has a length of 40 inches (102 mm) along its longitudinal dimension L, and has an arc length C of 6.725 mils (17×10^{-3} cm).

With the preferred inlet/outlet ratio of about 2:1 or more, the high velocity, heated air will be supplied to the plenum chamber 46 faster than it can be discharged, so that the heated air will be compressed within the manifold plenum chamber. This assures that the jets of hot air which are discharged through the outlet apertures 54 are uniform in pressure and velocity along the length of the dryer head, so that the printed sheet is dried uniformly as it is transferred through the exposure zone Z.

The air distribution baffle tube 64 is supported on the inlet end by the end plate 50, and on its discharge end by flange segments 64F which engage the internal bore of the dryer head 36 and positions the baffle tube in the center of the plenum chamber 46.

Referring now to FIGURE 6, FIGURE 7, FIGURE 8 and FIGURE 9, the heating element 38 is preferably an electrical resistance heater having elongated resistance heater sections 38C, 38D which are integrally formed and folded together about at a common end 38E. The resistance sections 38C, 38D are substantially co-extensive in length with the air delivery baffle tube 64. Each section 38C, 38D is electrically connected to a power conductor 72, 74, respectively, for connecting the resistance heating element 38 to an off-press source of electrical power.

The resistance heater sections 38C, 38D are mechanically stabilized by an end connector 76, and are enclosed within a tubular, thermally conductive sheath 78. Radial expansion of the half sections 38C, 38D is limited by the sidewall of the sheath 78, thus assuring efficient heat transfer, while the sheath provides longitudinal support for the elongated resistance heater sections within the inner airflow passage 68. The heating element half-sections 38C, 38D thus form a continuous loop resistance heating circuit which is energized through the power conductors 72, 74.

The tubular sheath 78 is received within the bore 58 and is welded to the end block 56. The tubular sheath 78 thus provides an opening through the end block 56 to permit insertion and withdrawal of the heating element 38 for replacement purposes. The heating element 38 is dimensioned for a sliding fit within the sheath 78 at ambient temperature. The end cap 76 is releasably secured to the end block 56 by a hold-down metal strap (not illustrated). The distal end 78B of the sheath is sealed by an end cap 78C to prevent leakage of high velocity air out of the distribution manifold chamber 46.

Referring now to FIGURE 2, FIGURE 4, and FIGURE 5, the extractor head 40 is coupled to the back side of a pair of identical dryer heads 36A, 36B. The dryer heads 36A, 36B are separated by a longitudinal air gap 80 which opens in air flow communication with an extractor manifold chamber 82, thereby defining a manifold inlet port. The extractor manifold chamber 82 is enclosed by the end plates 48, 50 and by housing panels 40A, 40B, 40C and 40D. The extractor housing panels 40C, 40D are secured and sealed by a welded union to the dryer heads 36A, 36B.

According to another aspect of the present invention, the multiple air flow apertures 54 of each dryer head 36A, 36B are arranged in linear rows R1, R2, respectively, and extend transversely with respect to the direction of sheet travel as indicate by the arrows S in FIGURE 3. The rows R1, R2 are longitudinally spaced with respect to each other along the sheet travel path. Each air jet expands in a conical pattern as it emerges from the airflow aperture 54. Expanding air jets from adjacent rows intermix within the exposure zone Z, thereby producing turbulent movement of high velocity hot air which scrubs the processed side of the sheet S as it moves through the exposure zone Z. Preferably, balanced air pressure is applied uniformly across the exposure zone Z to ensure that the moist air layer is completely separated and extracted from the freshly printed sheets.

In the exemplary embodiment, the pressure of the high velocity air as it is discharged through the inlet port 66 into the heat transfer passage 68 is about 10 psi (7031 Kgs/m^2). The inlet suction pressure in the longitudinal air gap 80 of the extractor is preferably about 5 inches of water (12.7×10^3 Kgs/cm^3).

As shown in FIGURE 3 and FIGURE 5, the extractor manifold inlet port 80 is coupled in air flow communication with the exposure zone Z for extracting heat, moisture laden air and volatiles out of the dryer. The extractor manifold chamber 82 is coupled in air flow communication with an exhaust fan 84 by an air duct 86. The air duct 86 is coupled to the extractor manifold chamber 82 by a transition duct fitting 88.

The high velocity, heated air which is discharged onto the printed sheet S is also extracted along with the moisture and volatiles through the air gap 80 into the extractor chamber 82. Ambient air, as indicated by the curved arrows, is also suctioned into the exposure zone Z and through the longitudinal air gap, thus assuring that hone of

the hot air, moisture or volatiles will escape into the press area. Extraction from the exposure zone Z is enhanced by directing the hot air jets along converging lines whose intersection defines an acute angle alpha (α), as shown in FIGURE 5.

The air flow capacity of the exhaust fan 84 is preferably about four times the total airflow input to the dryer heads. This will ensure that the exposure zone Z is maintained at a pressure level less than atmospheric thereby preventing the escape of hot air, moisture laden air and volatiles into the press room.

Claims

1. A hot air dryer (10) for installation in a printing press (12), said dryer comprising a dryer head (36) having a housing member (36W) defining an air distribution chamber (46), the housing member having an airflow inlet port (52) for receiving high velocity air and an airflow discharge port (54, 55) for directing heated air onto a substrate (S), and including a heating element (38) disposed in the air distribution chamber, characterized in that:
   an air delivery tube (64) is disposed in the air distribution chamber, the air delivery tube having an elongated airflow passage (68) connecting the inlet port in airflow communication with the air distribution chamber; and
   the heating element (38) is disposed within the elongated airflow passage (68) of the air delivery tube (64).

2. A hot air dryer (10) as defined in claim 1, characterized in that:
   pneumatic connector means (70) are coupled to the air delivery tube (64) for connecting the elongated air flow passage (68) to a source of high velocity air.

3. A hot air dryer (10) as defined in claim 1 or claim 2, characterised in that:
   electrical conductors (72, 74) are coupled to the heating element (38) for connecting the heating element to a source of electrical power.

4. A hot air dryer (10) as defined in any one of claims 1 to 3, characterized in that:
   an end block (56) is coupled to the housing member (36) and to the air delivery tube (64) for sealing the interface between the air delivery tube and the housing member.

5. A hot air dryer (10) as defined in any one of claims 1 to, characterised in that:
   an end block (56) is coupled to the housing member (36), the end block having a body portion intersected by an axial bore (58), a counterbore (60) and a radial inlet bore (62) communicating with the counterbore;
   the heating element (38) having an end portion (38A) projecting through the axial bore and counterbore; and,
   the air delivery tube (64) having an end portion (64B) disposed in the counterbore (60) with its elongated airflow passage (68) being coupled in airflow communication with the radial inlet bore (62).

6. A hot air dryer (10) as defined in any one of the preceding claims, characterized in that:
   the elongated heating element (38) comprises an electrical resistance heater (38C, 38D).

7. A hot air dryer (10) as defined in claim 6, characterized in that:
   the heating element (38) has first and second resistance heater sections (38C,38D), the sections being joined at a common end (38E) and disposed in side-by-side relation.

8. A hot air dryer (10) as defined in any one of the preceding claims, characterized in that:
   a tubular, thermally conductive sheath (78) is disposed within the elongated airflow passage (68); and,
   the heating element (38) is disposed within the sheath.

9. A hot air dryer (10) as defined in any one of the preceding claims, characterized in that:
   an extractor head (40) is coupled to the dryer head (36), the extractor head including a housing member (40A, 40B, 40C, 40D) defining an extractor manifold chamber (82), the extractor head having an elongated inlet port (80) for extracting air from a dryer exposure zone Z into the extractor manifold chamber, and having discharge means (84, 86, 88) coupled to the extractor head for exhausting air from the extractor manifold chamber.

10. A hot air dryer (10) as defined in any one of the preceding claims, characterized in that:
    the airflow discharge port (54) comprises multiple airflow apertures.

11. A hot air dryer (10) as defined in any one of the preceding claims, characterized in that:
    the air discharge port (54) comprises an elongated slot (55).

12. A hot air dryer (10) as defined in any one of the preceding claims, characterized in that:
the dryer head (36) is adapted for installation in an interstation position between adjacent printing press units (20A, 20B, 20C, 20D, 18) of a printing press (12), with the airflow discharge port (54, 55) facing the processed side of a substrate (S) as it is transported along a substrate travel path.

13. A hot air dryer (10) as defined in any one of the preceding claims, characterized in that:
the dryer (10) includes a second dryer head (36B) disposed in side-by-side relation with the first dryer head (36A) in a position facing the freshly processed side of a substrate (S) as it moves through a dryer exposure zone (Z) along a substrate travel path, the second dryer head (36B) having a housing member (36W) defining a second air distribution chamber (46), the housing member of the second dryer head including an inlet port (52) for receiving high velocity air and a discharge port (54, 55) oriented for directing heated air toward the sheet travel path, with the dryer heads being separated from each other by a longitudinal air gap (80); and,
an extractor head (40) is coupled to the dryer heads (36A, 36B), the extractor head including a housing member (40A, 40B, 40C, 40D) defining an extractor manifold chamber (82) and coupled in air flow communication with the longitudinal air gap (80), and having discharge means (84, 86, 88) coupled in air flow communication with the housing member for exhausting air from the extractor manifold chamber (82).

14. A hot air dryer (10) as defined in claim 13, characterized in that:
the discharge ports (54, 55) of the dryer heads are arranged in first and second rows (R1, R2), respectively, the rows being separated from each other along the substrate travel path, wherein heated air discharged from the discharge ports intermix with each other in the dryer exposure zone (Z).

15. A hot air dryer (10) as defined in claim 13 or claim 14, characterised in that:
the discharge ports (54, 55) of the first and second dryer heads are oriented for directing heated air along first and second converging lines (FIGURE 5), respectively.

16. A method for drying a freshly processed substrate (S) in a printing press (12) characterized by the steps:
directing high velocity air through an air delivery tube (64) which is disposed within an air distribution chamber (46);
heating high velocity air flowing through the air delivery tube by heat transfer contact with an elongated heating element (38) disposed within the air delivery tube; and,
discharging heated air from the air distribution chamber onto the freshly processed substrate (S).

17. A method for drying a freshly processed substrate (S) as defined in claim 16, characterized by the step:
compressing the heated air in the air distribution chamber (46) before the heated air is discharged.

18. A method for drying a freshly processed substrate (S) as defined in claim 16 or claim 17, characterised by the steps:
discharging heated air from the air distribution chamber (46) through an outlet port (54, 55); and
supplying the high velocity air to the air distribution chamber (46) through an inlet port (52) having an inlet flow area which is greater than the outlet flow area of the outlet port.

19. A method for drying a freshly processed substrate (S) as defined in any one of claims 16 to 18, characterised by the steps:
discharging jets of heated air from the air distribution chamber (46) through first and second rows (R1, R2) of outlet apertures (54, 55); and
intermixing air jets from the first and second rows in an exposure zone (Z).

20. A method for drying a freshly processed substrate (S) as defined in any one of claims 16 to 18, characterized by the steps:
discharging jets of heated, pressurized air from the air distribution chamber (46) through first and second rows (R1, R2) of outlet apertures; and
directing air jets discharged from air flow apertures of the first and second rows (R1, R2) along first and second converging lines (FIGURE 5), respectively.

21. A method for drying a freshly processed substrate (S) as defined in any one of claims 16 to 20, characterised by the steps:
installing first and second dryer heads (36A, 36B) in side-by-side relation on a printing press (12) in a position facing the processed side of a freshly processed substrate as it

travels through a dryer exposure zone (Z), the dryer heads being separated from each other by a longitudinal air gap (80);

supplying high velocity air to each dryer head (36A, 36B) through first and second air delivery tubes (64) which are disposed within an air distribution chamber (46) in each dryer head, respectively;

heating high velocity air flowing through each air delivery tube (64) by heat transfer contact with an elongated heating element (38) disposed within each air delivery tube;

discharging heated air from each dryer head through the dryer exposure zone (Z) and onto the freshly processed substrate (S); and

extracting air from the exposure zone (Z) through the longitudinal air gap (80).

22. A method for drying a freshly processed substrate (S) as defined in claim 21, characterized by the steps:

discharging heated air from each dryer head (36A, 36B) through an airflow outlet aperture (54, 55); and

supplying high velocity air to each dryer head through an inlet port (52) having an effective inlet flow area which is greater than the combined outlet flow areas of the air flow outlet apertures (54, 55).

23. A method for drying a freshly processed substrate (S) as defined in claim 21, or claim 22, characterised by the steps:

discharging jets of heated air from the first and second dryer heads (36A, 36B) through first and second rows (R1, R2) of outlet apertures (54, 55), respectively; and

intermixing air jets from the first and second rows in the exposure zone (Z).

24. A method for drying a freshly printed substrate (S) as defined in any one of claims 21 to 23, characterized by the steps:

discharging jets of heated air from the first and second dryer heads (36A, 36B) through first and second rows (R1, R2) of outlet apertures (54, 55), respectively; and

directing air jets discharged from air flow apertures of the first and second rows (R1, R2) along first and second converging lines (FIGURE 5), respectively.

25. A method for drying a freshly processed substrate (S) as defined in any one of claims 21 to 24, characterised by the step:

extracting air from the exposure zone (Z) at a volume flow rate through the longitudinal air gap (80) which exceeds the total volume flow rate of air discharged from the first and second dryer heads (36A, 36B).

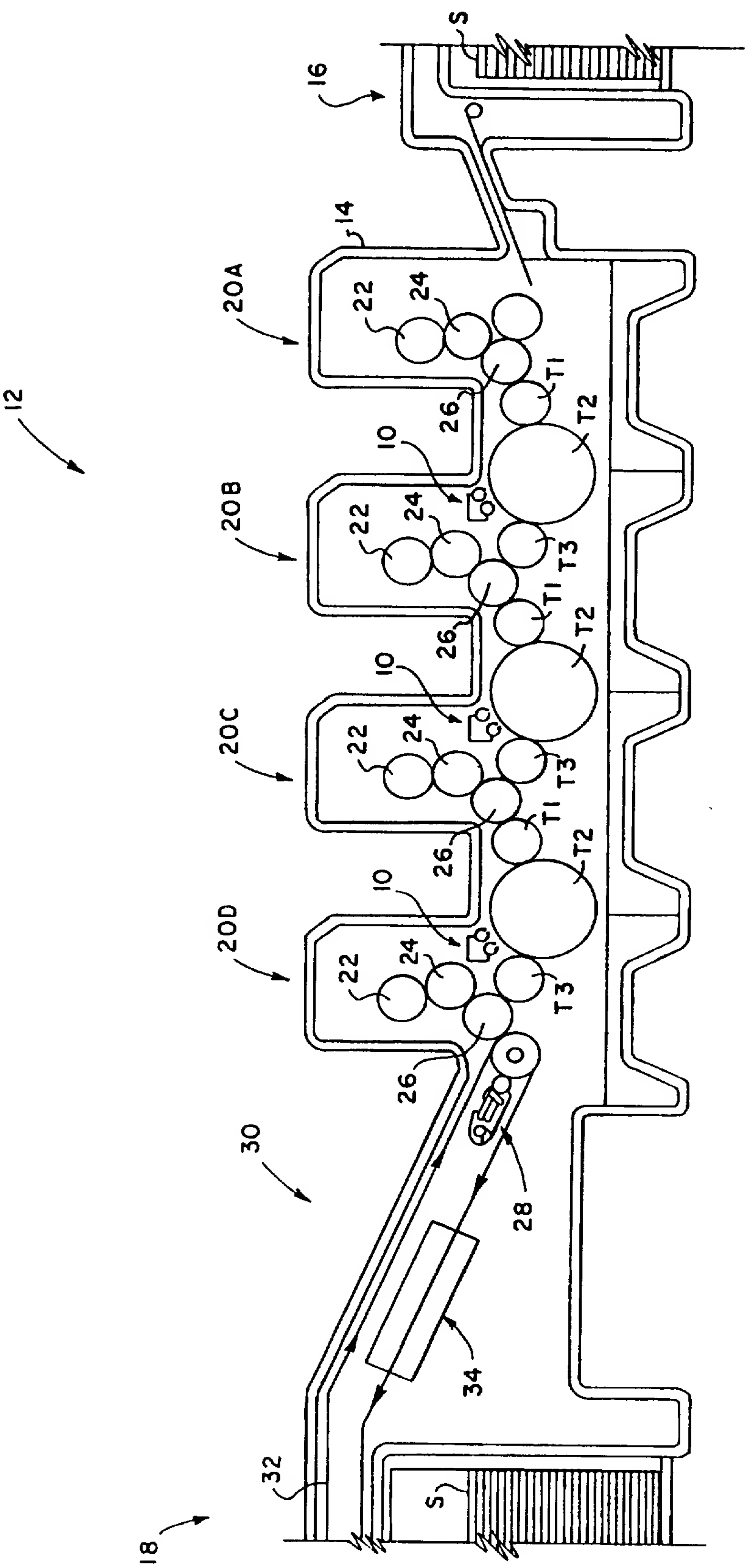


FIG. 1

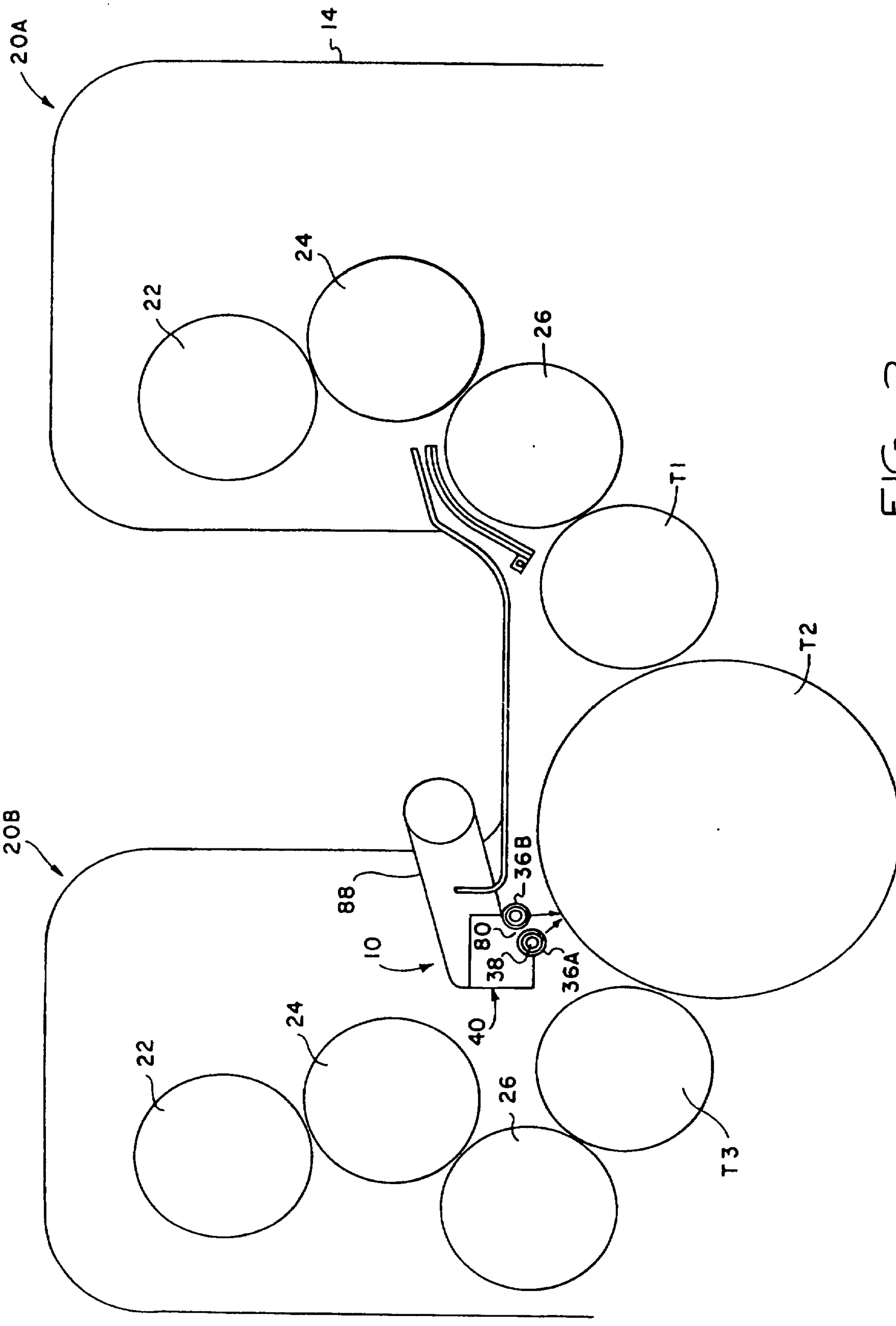
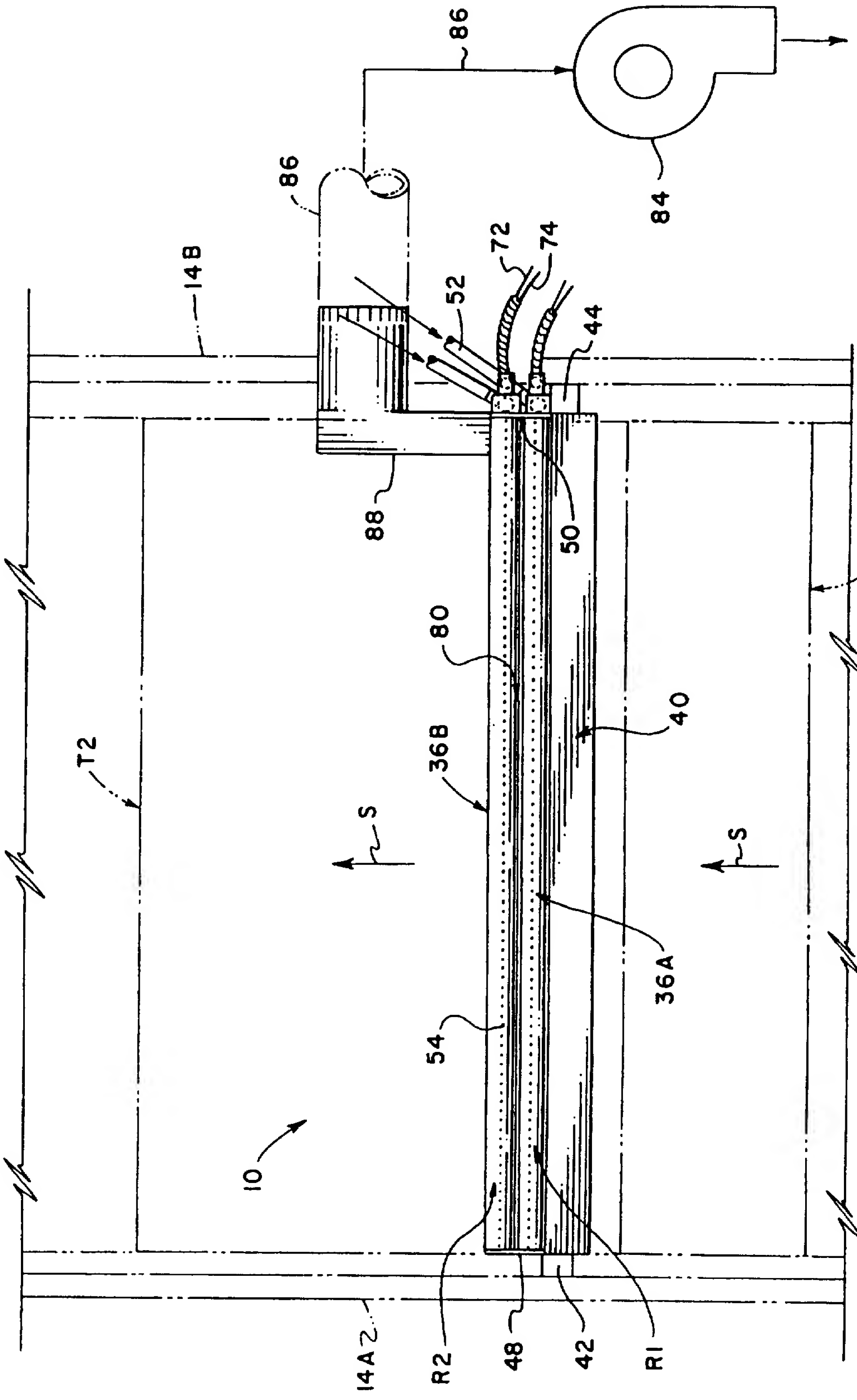


FIG. 2



86
84
86
14B
52
72
74
44
88
50
80
T1
40
T2
36B
S
S
36A
54
10
14A
R2
48
42
R1

FIG. 3

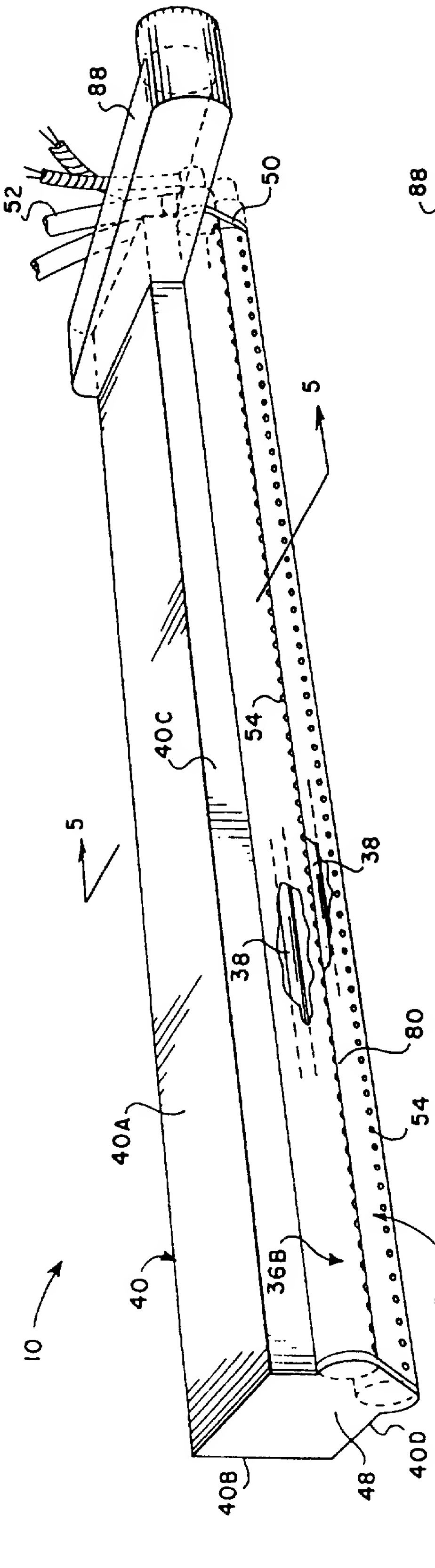


FIG. 4

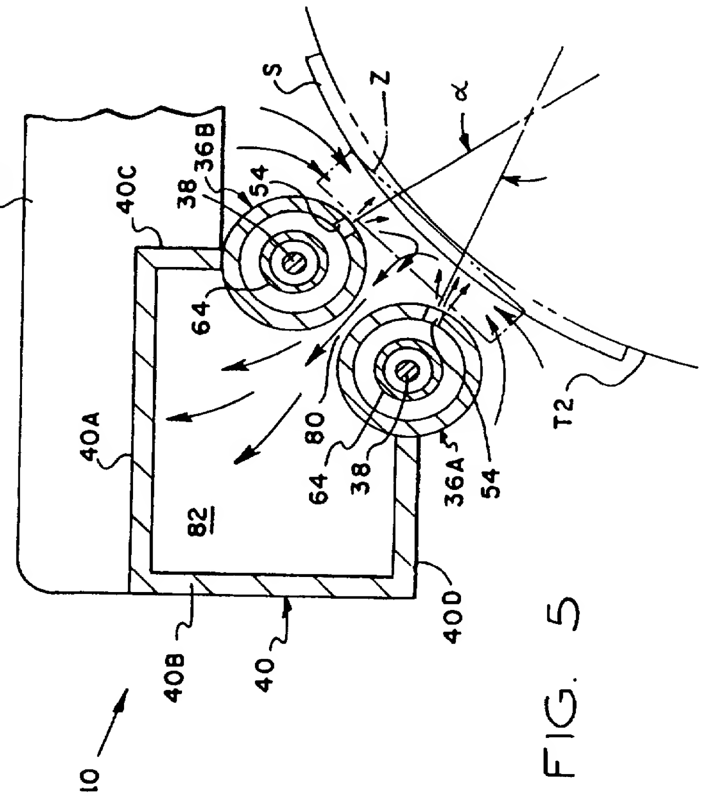


FIG. 5

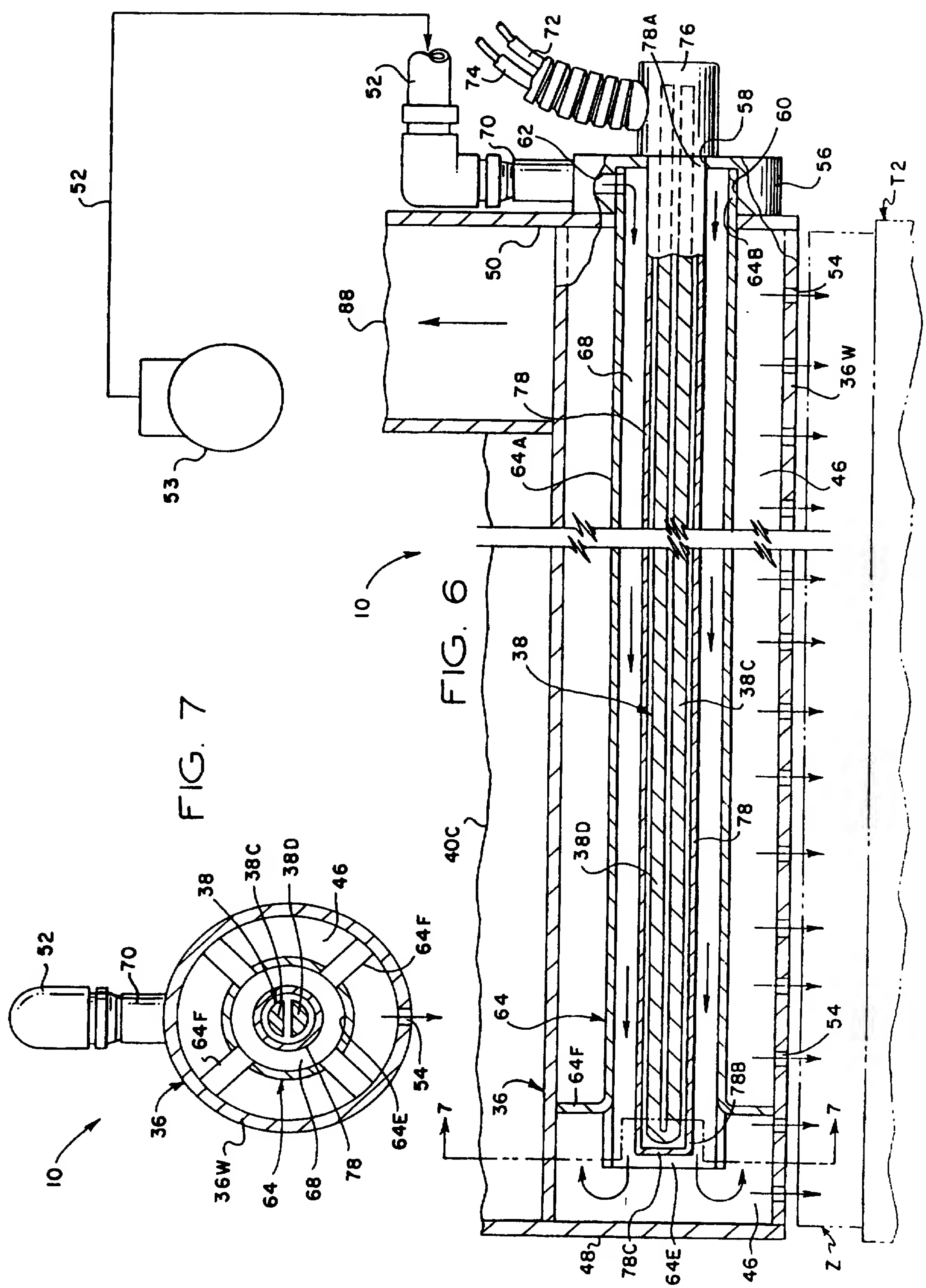


FIG. 6

FIG. 7

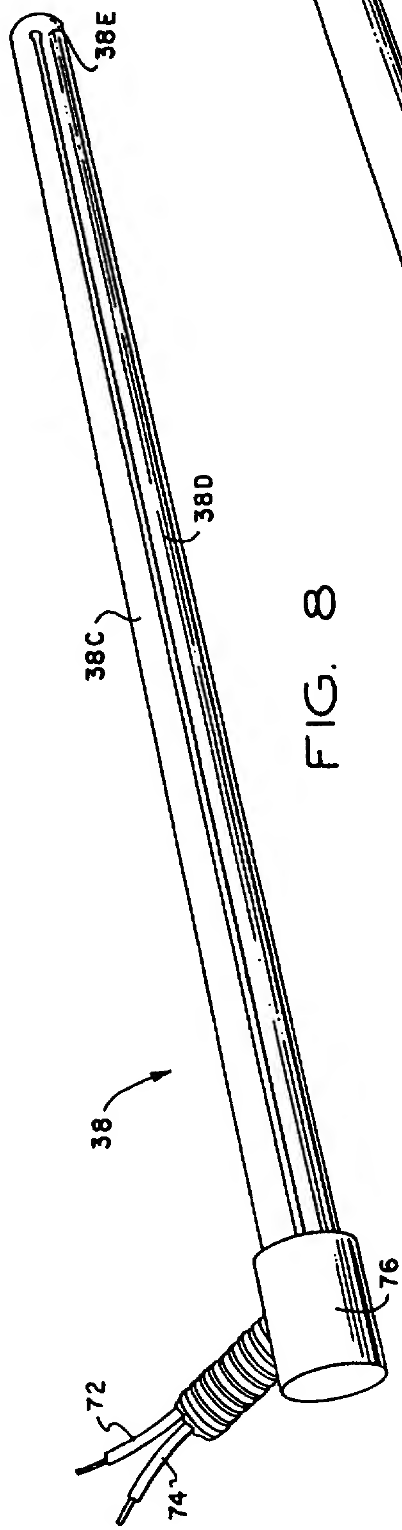


FIG. 8

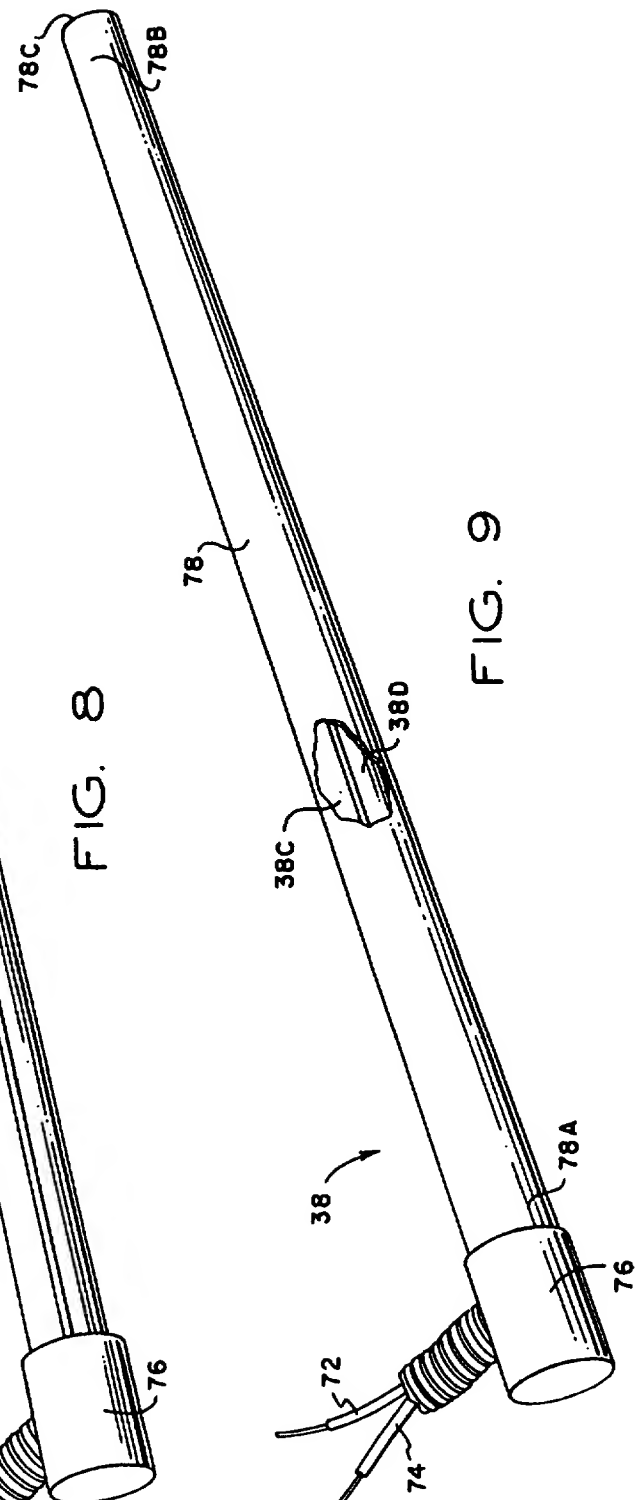


FIG. 9

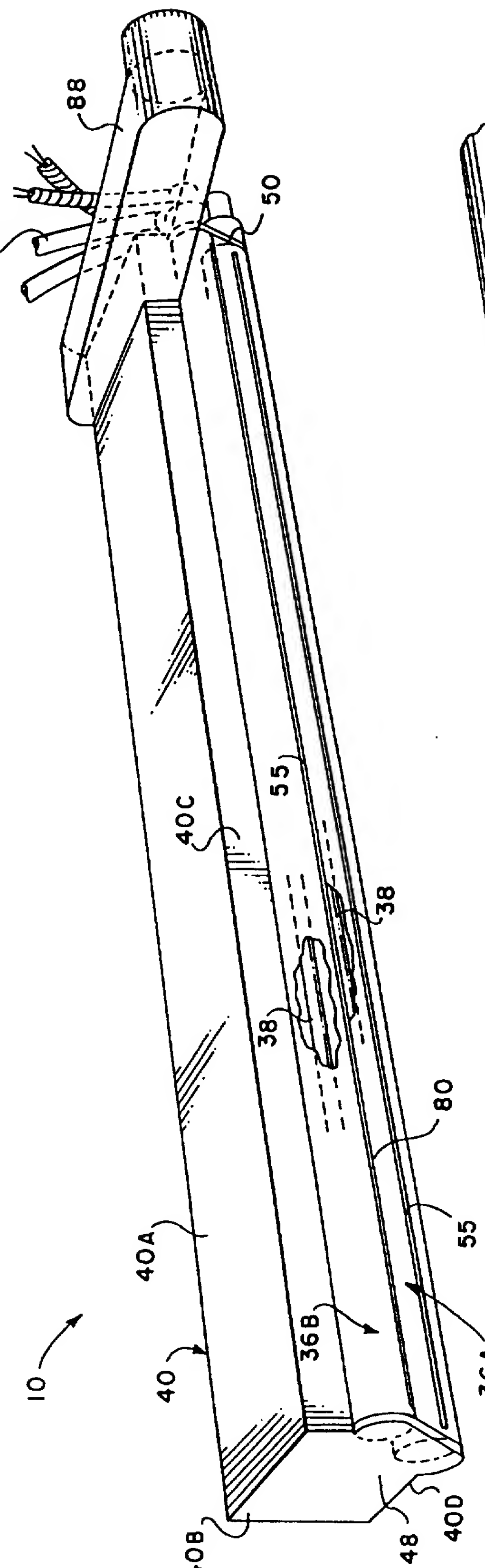


FIG. 10

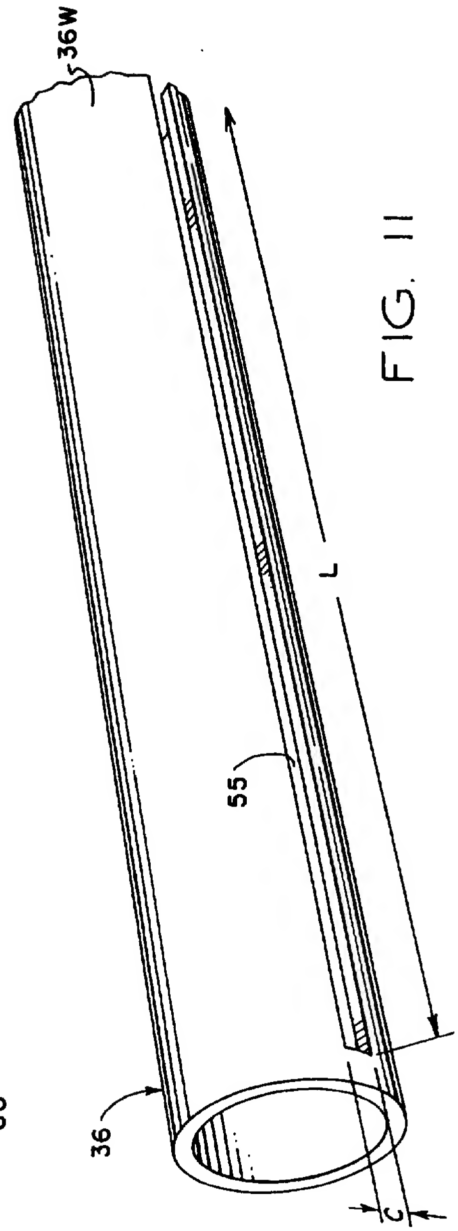


FIG. 11

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 94 30 5812

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION
X	US-A-2 683 939 (MASTER APPLIANCE) * the whole document *	1-4,6,7, 10,16,17	B41F23/04 F26B21/00
Y		9,12,13, 19,21,23	
Y	FR-A-1 340 311 (ATELIERS ET CHANTIERS DE NANTES) * the whole document *	9,13,19, 21,23	
Y	US-A-1 737 174 (WILLIAM J. PRICE) * the whole document *	12	
A	US-A-3 079 702 (JAMES HALLEY & SONS)		
A	WO-A-90 03888 (PLATSCH)		

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

B41F
F26B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	16 January 1995	Loncke, J

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

XP 000232825

4560 Papier + Kunststoff Verarbei
26(1991)Juni, No.6, Frankfurt am

p.129

B41F23/08

Veredelung

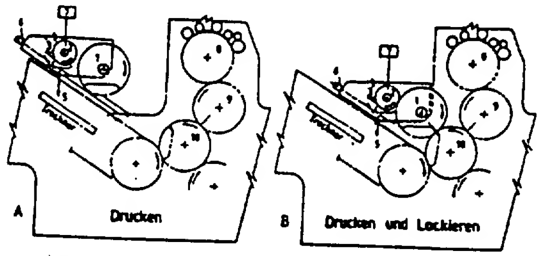
Lackier-Aggregat für Speedmaster-Maschinen

Mit einem Dahlgren-Lackierwerk LPC erhalten Speedmaster-Drucker die Möglichkeit, vorhandene Maschinen aufzurüsten, um nach wie vor mehrfarbig zu drucken und zusätzlich zu lackieren, ohne daß hierfür ein Druckwerk geopfert werden muß. Eine Vierfarben-Maschine zum Beispiel bleibt eine Vierfarben-Maschine, das Lackieren wird zusätzlich ermöglicht.

Der Einbau der LPC-Einheit erfolgt zwischen dem letzten Druckturm und dem Ausleger. Das Lackwerk kann durch Knopfdruck zur Auslage hin hydraulisch verfahren werden, wodurch für Service- und Einstellarbeiten der freie Zugang zum letzten Werk erhalten bleibt.

Da es sich bei der LPC-Einheit um ein echtes Lackierwerk handelt, ist sowohl Schutzlackierung als auch Hochglanzlackierung möglich; die gewünschte Lackauftragsmenge wird durch die Gravurtiefe der Schöpfwalze (Anilox-Walze) festgelegt. Vollflächige Lackierung ist ebenso möglich wie Spot-Lackierung, wobei ein Registersystem die passergenaue Lackübertragung erleichtert.

Je nach Bedarf kann UV- oder Dispersionslack eingesetzt werden. Ein Ablagern oder Austrocknen des Lacks wird durch ein kontinuierliches Umpumpen vermieden, was wiederum einen gleichmäßigen Lackauftrag gewährleistet.



1. Lackierzylinder
2. Schöpfwalze
3. Rakel
4. [illegible]
5. Lackumlaufsystem
6. Abhebevorrichtung
7. [illegible]
8. Plattenzylinder
9. Gummizylinder
10. Gegendruckzylinder

Zeichnung A zeigt das Lackierwerk in ausgefahrener Position, Zeichnung B im Eingriff mit dem Druckwerk, das heißt in Lackierposition.

LPC-Lackierwerke sind zur Zeit für Speedmaster 72 und 102 sowie für Mitsubishi-Maschinen verfügbar.

Das Augsburger Lieferwerk informiert auch über Trocknungs-Systeme, und zwar sowohl über IR-Heißluft-Trocknung als auch über UV-Härtung.

Aggregate

Optimierte Heiz- und Kühlwalzen

Eine deutlich verbesserte Zwangsführung der Kühl- und Heizmedien bei ihren Heiz- und Kühlwalzen hat die W. Hähl KG, Kieselbronn, durch Optimierungsmaßnahmen in der typischen Zapfen- und Bodenkonstruktion erreicht.

Entsprechende Heiz- und Kühlwalzen sind in Dimensionen von bis zu 1000 mm Durchmesser und von bis zu 10000 mm Länge lieferbar. Sorgfältig dynamisch ausgewuchtet verfügen sie über eine extreme Laufruhe und bieten über lange Betriebszeit sichere Funktion.

Druckvorstufe

Verbesserte Repetierkopiermaschinen

Die bisherigen Universal-Repetierkopier - Maschinen PC-801 und PC-802 von Screen, die bekanntlich auch als manuelle Kontaktkopierrahmen für die Plattenkopie genutzt werden können, wurden durch optimierte Konstruktionen abgelöst. Die drei Varianten des Modells PC-803 sind wie folgt ausgelegt:

- PC-803-E deckt die Maschinenklasse I ab (effektives Kopierformat 73 x 62 cm);
- PC-803-G ist für das IIIB-Format (77 x 103 cm) bestimmt;
- PC-803-I reicht bis zum Ver Format (131 x 105 cm).

Die grundsätzlichen Abläufe wurden beibehalten, die jetzt geschlossene Kompaktbauweise mit zusätzlichen automatischen Mechanismen ermöglicht aber staubfreieres Kopieren und mindert die Geräuschbelastung. Durch die neue UV-Lichtschutzscheibe kann der Bediener alle Abläufe visuell kontrollieren.

Bei den großen Modellen G und I fährt das Lampenhaus in seitlicher Richtung mit, und die bewegliche 4-kW - Metallhalogenidlampe verstellt sich auch in der Höhe automatisch. Dies gestattet bei kleineren Filmvorlagen (zum Beispiel Etiketten) oder im Bereich der Umschlagseitenproduktion eine noch bessere Ausleuchtung, höhere Lichtintensität und damit verkürzte Belichtungszeiten.

Einer eventuellen Lichthofbildung an der Maskenkante wird durch die bessere Maskenkonstruktion mit reduziertem Abstand zwischen Maske und Glasscheibe vorgebeugt.

Sobald bei den Kopier- und Montage-Maschinen ▶

The Versatile Two in One

DAHLGREN®

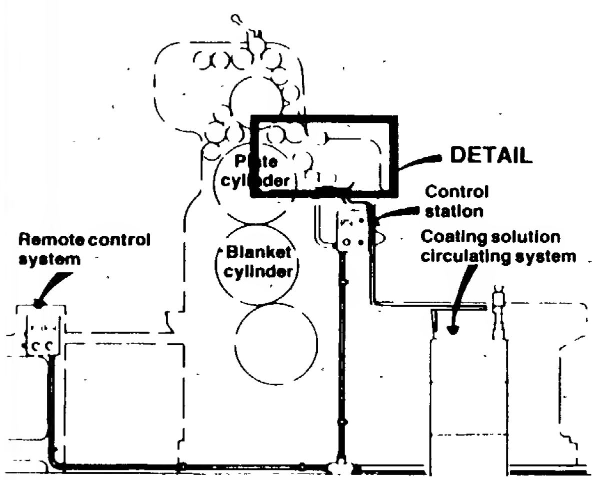
Coater-Dampener

FINGERTIP CONTROL
IMMEDIATE RESPONSE
CONTINUOUS-DUTY OPERATION
PRECISION LATERAL CONTROL
SIMPLICITY IN MECHANICS & SETTING

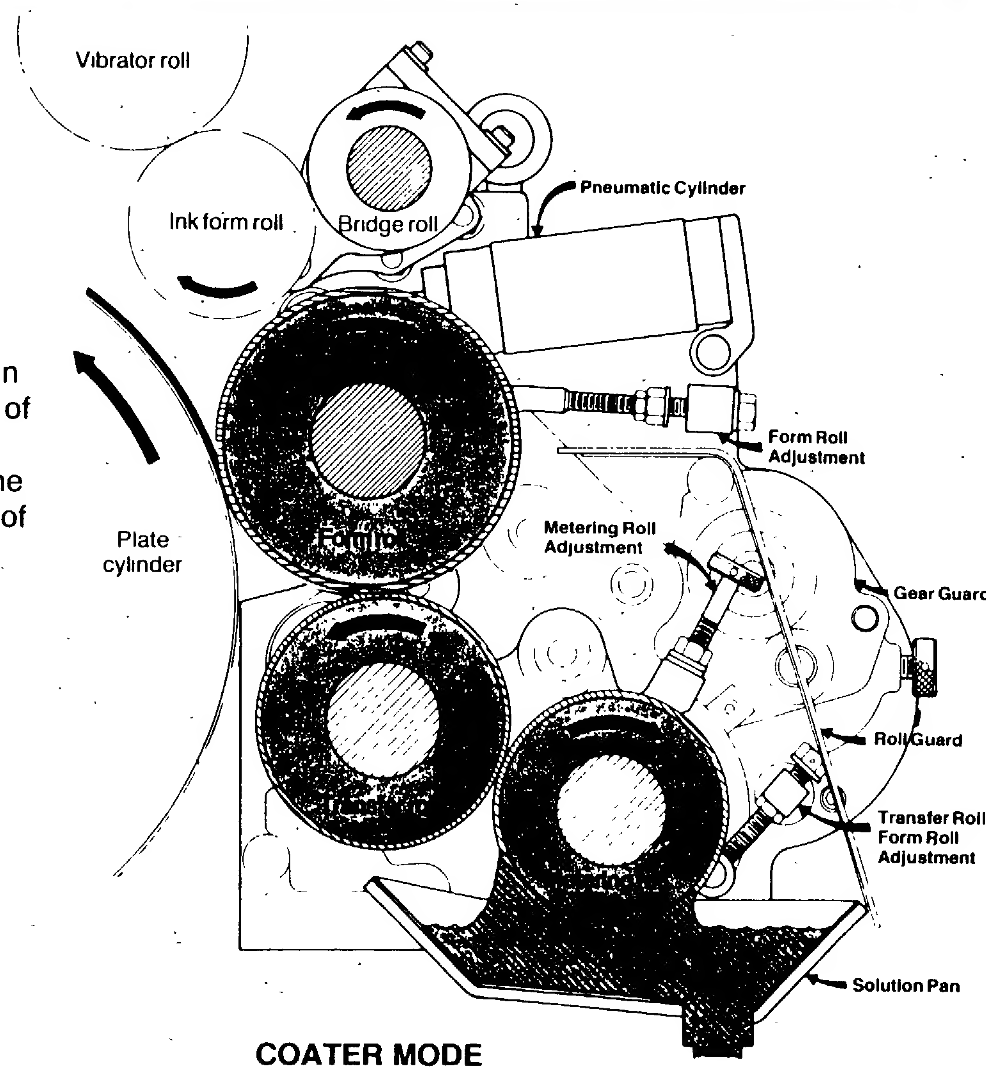
SOLUTIONS THROUGH MEASUREMENT

DAHLGREN
Coating System

The Dahlgren converts from a dampener to a coater in a matter of minutes. You need only choose the mode of operation. In the coater mode of operation the bridge roll is pulled away from the ink form roll. This allows the **DAHLGREN®** form roll to deposit a metered amount of acrylic coating solution to the entire surface.



COATER MODE



COATER MODE

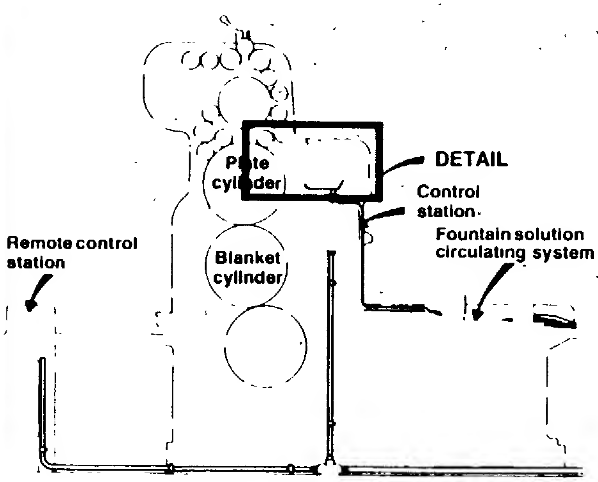
DETAIL

LEGEND

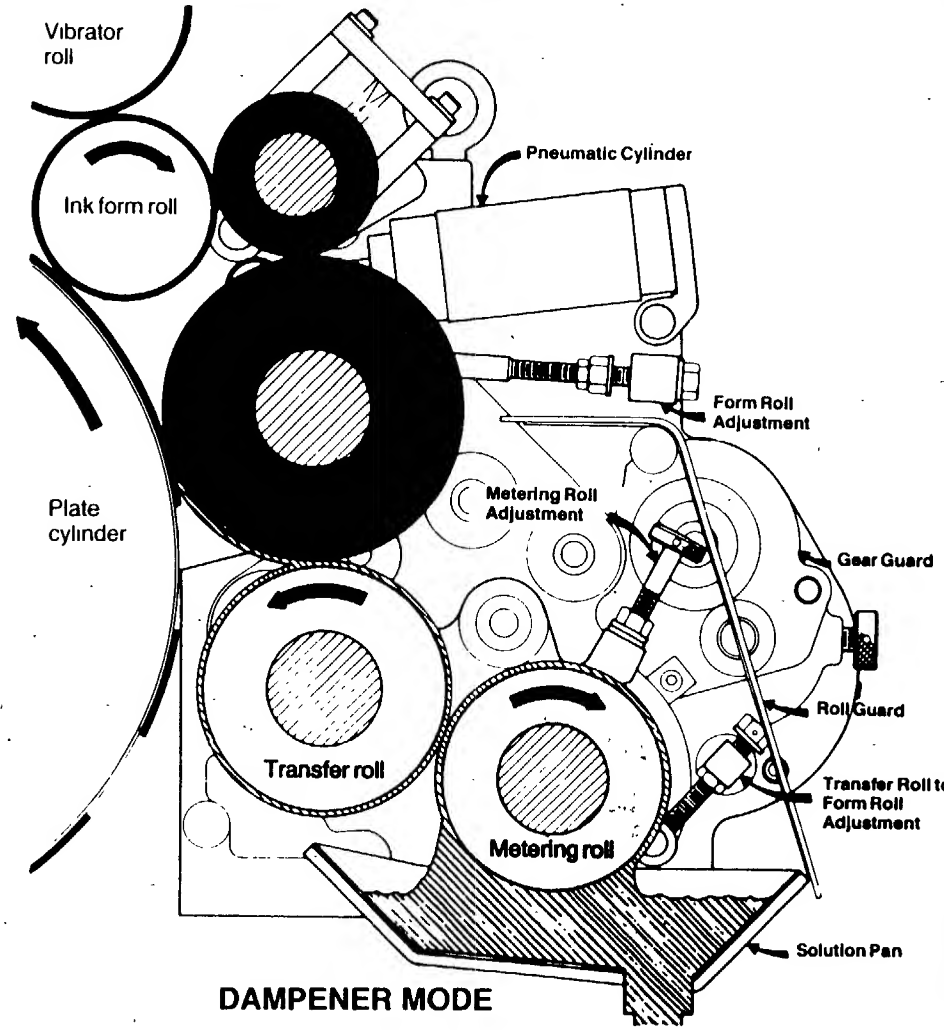
Coating Solution
Press
Dahlgren Equipment

DAHLGREN
Dampening System

The DAHLGREN® converts from a coater to a dampener in minutes. You need only choose the mode of operation desired. In the dampener mode of operation there is an extra inking form roll running against the plate cylinder.



DAMPENER MODE



DAMPENER MODE

DETAIL

LEGEND

- Ink
- Fountain Solution
- Press
- Dahlgren Equipment

[illegible] other...

[illegible] will equal or exceed the [illegible] conventional manner.

[illegible]HLGREN® Company reveals the following:

Odor
[illegible] test panels were found to contain no [illegible] due to the coating. Nor was there any odor absorbed by the client's product itself. There is however, a slight aroma on a freshly [illegible] sheet that dissipates as the coating [illegible]

Grease Resistance
Acrylic coatings are quite resistent to soilage due to fingerprints or other oily base substances that may come into contact with [illegible] finish for a short term as can be expected in normal handling.

Blocking
The coating will not block at normal or elevated temperatures typical of those encountered in warehousing or shipping.

Water Resistance
[illegible] will withstand normal, short-term [illegible] exposure which may be experienced [illegible] kitchen or a laundry, without serious [illegible]mage.

Slip Angle
[illegible] slip angle of the acrylic coating, as measured by the coefficient of friction me[illegible] indicates a 17 to 18 degree slide angle.

Stamp Acceptance
[illegible] Coating will accept price stamping wi[illegible] hours after its application, with no smea[illegible] or wipe-off after only 20 seconds of drying time.

- 100% elimination of offset spray powders [illegible] a full color run.
- Housekeeping problems related to the usage of offset spray powder are ended forever for the packaging manufacturer, the label printer and most lithographers in general. There is no longer any reason for spray powders to dust off in the finished product line.
- The aesthetic appearance of sheets coated by the **DAHLGREN®** Coater-Dampener using an acrylic coating is dramatically enhanced. The rough gritty texture of conventional varnish-spray powder finishes are replaced by a noticeably smoother surface. The reason is quite apparent under an electron microscope, as it reveals all the 'peaks and valleys' created by varnish-offset spray methods of coating, while the acrylic coating applied with the **DAHLGREN®** Coater-Dampener is nearly smooth, except for the sheet grain and texture.
- Visual appeal of coated sheets is also improved, as no unsightly layer of offset spray powder appears on the surface of the product to detract from the optical values of the finish.
- The Coater-Dampener eleminates the wasted floor space that used to be taken up with drying skids for boards and sheets coated in the old-fashioned way with varnishes and offset spray powders.
- The same machines, set-ups and stacking procedures may be utilized as before for cartons and/or sheets.
- The need to leave glue flaps uncoated as with conventional coating methods is eliminated with the **DAHLGREN®** Coater-Dampener.
- In line coating is now a reality, thanks to the **DAHLGREN®** System. Subsequent finishing operations can now be performed within a matter of hours after the coating is applied.

DAHLGREN
MANUFACTURING COMPANY

3305 Manor Way, Dallas, Texas 75235
in Texas and Canada tel (214) 357-4621
Toll Free 800-527-4681
Telex 73-0329 Dahlgren Dal

1-19-3 Nishi-Shinbashi
Minato-Ku
Tokyo - Japan
Tel (03) 501-1301
Telex 02225441

172 Sterrebeekstraat
B-1930 Zaventem Zuid 7
Belgium
Tel (02) 721.29.14 (3 L)
Telex 25604 Dahlbr B

Printed by Intenso Offset BV Amsterdam with Dahlgren Dampening System

DAHLGREN®

DAMPENER DIVISION

World Leader for more than twenty years in Graphic Arts Technology and Equipment

- **HIGH PERFORMANCE PUBLICATION WEB DAMPENERS**
- **DAMPENING SYSTEMS**
- **COATER-DAMPENING SYSTEMS**
- **LIQUID APPLICATION SYSTEMS**

Products are custom designed and manufactured to meet the customers needs.

WORLD WIDE PERFORMANCE AND SERVICE WARRANTY

Domestic and Foreign Patents Issued and/or Pending.

FOR FURTHER INFORMATION WRITE OR CALL

DAHLGREN®

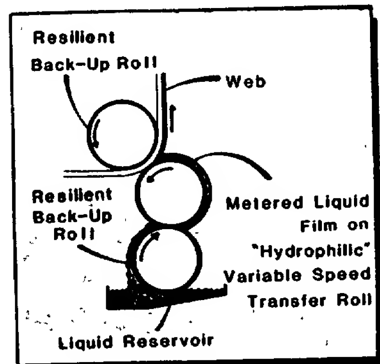
DAHLGREN MANUFACTURING COMPANY

3305 MANOR WAY, DALLAS, TEXAS 75235
IN TEXAS and CANADA TEL. (214) 357-4621
TOLL FREE 800-527-5301
TELEX 73-0329 DAHLGREN DAL

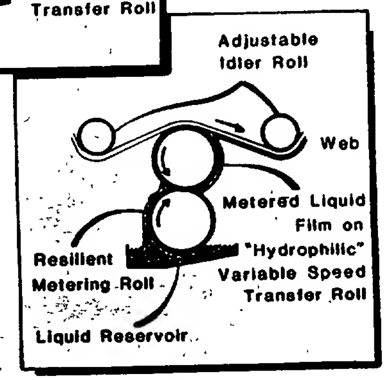
STERREBEEKSTRAAT 172
B-1930 ZAVENTEM-ZUID 7
(BRUSSELS), BELGIUM
TEL: 721-29-14
TELEX: 25-604 DAHLBR B

No. 2 FUTABA BLDG.
19-3 NISHI-SHIMBASHI
1-CHOME MINATO-KU
TOKYO, JAPAN
TELEX: 781/2225441

Liquid Application System (LAS®)



Coating Application



Moisturizing Application

Capabilities of the Dahlgren Liquid Application System

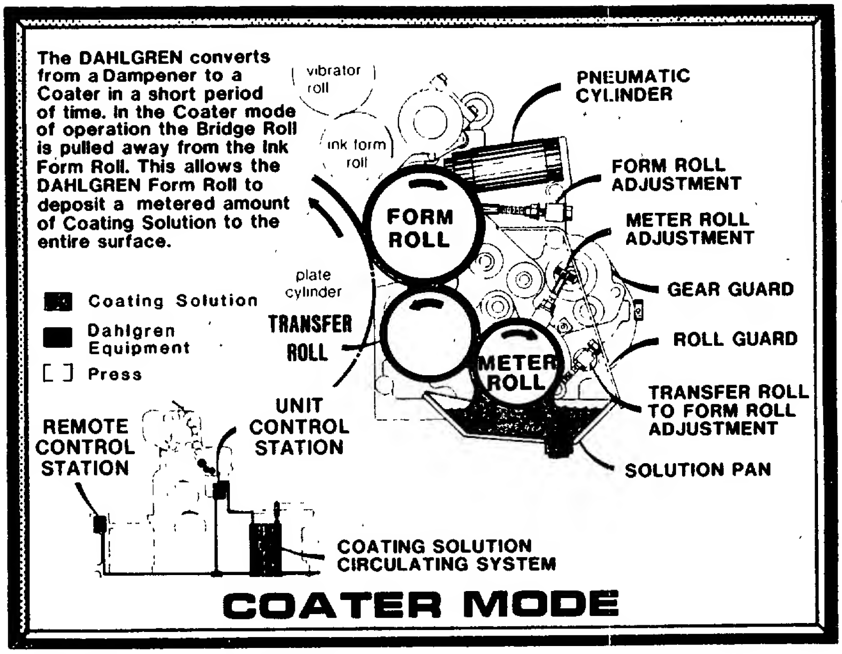
The system can apply a broad range of aqueous and non aqueous coatings at previously unachievable light functional coat weights. It maintains constant linear thickness throughout its entire speed range When changing web speeds it is not necessary to adjust the viscosity of the coating solution. Varying web widths can be run on the same unit without encountering edge build-up.

Control of the applied coat weight is within 1% Also, the system offers better control of the penetration of materials and coat weight remains the same regardless of sheet variations

Changing from one coating material to another is a fast and simple operation. Training operators is easy compared to the training required for other coating equipment.

The Dahlgren Liquid Application System can be applied to many paper-making and converting functions — such as moisture profiling, decurling, surface coating, controlled penetration coating, high solid starch applications and other difficult and costly operations

Coater-Dampener System



- 100% elimination of offset spray powders on a full color run
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- The COATER-DAMPENER eliminates the wasted floor space that used to be taken up with drying skids for boards and sheets coated in the old-fashioned way with varnishes and offset spray powders.
- The same machines, set-ups and stacking procedures may be utilized as before for cartons and/or sheets

Characteristics of the acrylic coating as applied by the

Dahlgren Coater-Dampener .

Gloss

Acrylic coatings applied with the COATER DAMPENER will meet or exceed meter tests for varnishes of the same thickness

Coatings applied by the DAHLGREN SYSTEM provide superior glue ability, even though applied over the entire sheet 100% fiber tear is experienced with water based adhesives or hot melts This proves the adhesive bond is stronger than the paper substrate itself Conventional varnish or spray powder finishes must be applied only over the printed area as they have a negative effect on glueability

COATER DAMPENER applied acrylic coatings do not yellow when exposed to ultraviolet of sunlight, while conventional varnishes are quite susceptible to yellowing

In bending test the acrylic coating did not crack on scored lines when the paper product was folded and set up